

THE EFFECT OF DIATHERMY UPON THE SECRETION OF BILE *

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Although passing years have witnessed increasing knowledge of the action of the high frequency current upon the animal body, information as to the influence of diathermy upon the secretory and metabolic activities of the various organs is still limited. Binger and Christie⁽¹⁾, among others, have shown that the passage of the high frequency current through any part of the body will cause an increase in the temperature of the part, including its center. As a result of his further work, Christie⁽²⁾ arrived at the conclusion that "the diathermy current penetrates the living cell, and heat production is intracellular as well as extracellular."

In the present investigation an attempt has been made to determine the effect of diathermy upon the activity of the liver cells as indicated by changes in the secretion of bile. That the efficiency of the biliary secretion may be to some extent an indication of the general state of liver function, is suggested by the work of Rous⁽³⁾, who has shown that impairment of bile secretion indicates disturbance of other liver functions as well.

Review of Literature

In 1913, Nagelschmidt⁽⁴⁾ demonstrated upon animals an increase in the secretion of bile after the application of diathermy to the liver region, which was at times twice the normal amount. In spite of the increased quantity, the ash content of the secretion was not usually changed. In the published reports of Nagelschmidt's works, available to us, no details of his experiments were given, only his conclusions being stated. Nagelschmidt also reported that, in early cases of cirrhosis of the liver and in passive hepatic congestion,

the ascites promptly disappeared and the size of the liver returned to normal. He further claimed⁽⁵⁾ that diathermy applied to the region of the liver and pancreas influenced the blood sugar level and the whole metabolism of carbohydrates, fats and proteins.

Bassler⁽⁶⁾, in 1926, reported improvement and apparent cure after the use of diathermy in two cases of cirrhosis of the liver following chronically infected gall bladders. Hunter⁽⁶⁾, in discussing Bassler's paper, stated that he had used diathermy in four similar cases with favorable results. Koza⁽⁷⁾ found the filling of the gall bladder accelerated during intravenous cholecystography by the administration of twenty minute applications of diathermy repeated three to four times during the filling period. He found that the regular roentgenograms could be taken much sooner while the contrast and distinctness of the shadows were equally good. This increased rate of excretion of the dye in the bile is one of the best direct evidences yet advanced in support of the stimulating action of diathermy upon the secretory activity of the liver.

Frisch and Lasch⁽⁸⁾ reported three series of experiments on twenty-four patients dealing with the influence of diathermy on liver function. In the first part of their investigation, confined to galactose excretion, they used two main groups of patients: (1) Those with normal livers, and (2) those with clinical evidence of pathological changes in the liver. They found that diathermy to the healthy liver resulted in an increased oxidation of the sugar and a decreased galactose excretion in the urine of 16-91 per cent. Two patients with cardiac congestion of the liver showed 72 and 77 per cent decrease in galactose excretion. Four cases of catarrhal jaundice showed clinical improvement and lessened galactose ex-

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cretion. In some cases, such as biliary obstruction and Laennec's cirrhosis, changes were small and variable. It is significant to notice that control days on these patients before the use of diathermy showed definitely greater excretion of sugar than control days after the use of diathermy, the effect of the diathermy being noticeable upon the succeeding control days.

In a second series of experiments by Frisch and Lasch on two patients, one a normal individual and the other having pericholangitic cirrhosis with icterus, a duodenal tube was passed through the empty stomach into the duodenum. Diathermy electrodes were applied and the spontaneously secreted duodenal contents collected for thirty minutes; collection was continued during a thirty minute current flow and for thirty minutes following. The normal individual showed an increase in bile secretion and concentration during and after diathermy, while in the patient with cirrhosis there was a decrease in bilirubin and variable changes in the cholesterol content of the secretion. The short period and method of collection of the secretion make this second series of little value. The classical work of Pfaff and Balch⁽⁹⁾, corroborated since by many investigators, has shown that normal variations in the hourly output of bile by the liver are so great that short periods of collection have little significance.

In a third series of experiments in six clinical cases, Frisch and Lasch studied the effect of diathermy to the liver upon the blood sugar level. In a case of nephrosclerosis the blood sugar was decreased 27 per cent while in a case of diabetes there was a decrease of 40 per cent. These cases were controlled by diathermy to the lumbar region. The number of experiments and the results obtained in this series of experiments do not warrant definite conclusions although the work seems to indicate a tendency to a lowering of the blood sugar following diathermy to the liver.

In 1930 Pagniez⁽¹⁰⁾ mentioned a case of alcoholic cirrhosis with ascites which showed improvement following a period of over three months treatment with diathermy to the liver.

Iacono⁽¹¹⁾ (1931) reported complete disappearance of ascites and improved general condition with diathermy to the liver in two cases of cirrhosis, but no improvement in a third case of cirrhosis or in a case of syphilitic hepatitis.

More recently Goldgruber⁽¹²⁾ reported the use of diathermy in a series of cases of liver disease which were catarrhal jaundice, icterus due to arsphenamine therapy, subacute and chronic types of cholangitis, and early cases of hepatic cirrhosis. Effects of the treatment upon the liver function were controlled by means of liver function tests including the galactose test, and the effect of diathermy upon the bile secretion was observed by means of the duodenal tube. The information on bile secretion obtained by the tube was not quantitatively accurate, but the quality of the bile changed from a small flow of pale green bile to a copious flow of dark colored bile. Bilirubin and later urobilin disappeared from the urine, but urobilinogen remained. Among 18 patients treated with diathermy there were two failures: one a case of cirrhosis with cholemic symptoms, and the other a case of syphilitic hepatitis which had begun to improve before diathermy was started and hence diathermy could not be given the credit.

In a second group Goldgruber used diathermy in the treatment of pain associated with cholecystitis, cholelithiasis, cholangitis and following cholecystectomy. Although other workers had used diathermy successfully in these conditions, this investigator was not able to obtain the same good results. It was often necessary to discontinue the treatment because of the unbearable pain resulting therefrom and it seemed probable that the increased bile secretion due to the diathermy could find no exit because of anatomical and functional interference, and that this caused increased tension and pain.

Experiments

A. First Series

In the dogs used in this series it was desired to obtain a constant external drainage of the bile. Several types of operation were used in the course of the experiments. The two stage operation described by Mann⁽¹³⁾ in 1921 was tried but proved unsatisfactory in our hands. The best results were obtained by the following procedure:

A right rectus incision was made and the gall bladder was located and freed from its attachments to the liver. Next the common bile duct was traced down to the duodenum and ligated in two places with linen. A search was made for extra bile ducts leading to the duodenum; these were ligated if found. After

this the gall bladder was opened at its tip and a specially prepared catheter was inserted. This catheter was made by vulcanizing a rubber collar one-eighth inch thick near the end of a piece of 16 F. catheter tubing from which the tip had been removed. A purse-string suture was placed around the catheter which had been inserted into the gall bladder, with the collar inside. A stab wound was then made lateral to the abdominal incision, and the tube pulled through. The gall bladder was fastened to the abdominal wall and the stab wound was closed snugly around the catheter by two stitches. The abdominal incision was then closed, covered with collodion, and the dog returned to its cage. Ether and sodium amytal were used for anaesthesia.

The dogs were put up on a constant standard diet,* and were fed their definite rations at 8 A. M. and 5 P. M. After feeding they were taken outside for a 15 minute run, returned to their cages, and in half an hour were ready for their experiment. During the first ten days following the operation no experiments were performed. On the eleventh day the dogs were put into a specially built frame for a few hours. The frame was of the type used by Pavlov, and similar to the ones described by Wisner and Whipple⁽¹⁴⁾, in which the dogs were supported by a canvas hammock nailed to a wooden frame. The dogs were put into these frames on alternate days for an increasing number of hours, until they were perfectly comfortable and at ease for twenty-four hours, often sleeping the greater part of that time. The bile was collected in test tubes, which were changed at definite intervals, and the quantities measured. Experiments were carried out with 3, 6, 8, 10, and 24 hour periods, but previous work had convinced us that such great variations exist in the hourly output of bile that only the 24 hour period should be used as a standard of comparison. In fact, there is a complete lack of regularity in the hourly flow of bile, in the human⁽⁹⁾ as well as in the dog,⁽¹⁴⁾ and to select experimental periods of only a few hours would have very little value. Therefore, the twenty-four hour period was adopted as the standard, although Wisner and Whipple⁽¹⁴⁾ used 6-hour unit collections in their work as representative of the whole day's output.

On the day of the experiment, the dogs were put in their frames at 8:30 A. M., and the collecting of bile was begun at 9 o'clock, being continued until 9 A. M. the next day. The dogs were fed at their regular hours, and were offered water every four hours. After the 24 hour period was over, a 48 hour interval of rest was given before the next experiment was started. Of the bile specimens collected during the experiment the quantity, the specific gravity, and the depression of the freezing point were determined. The specific gravity of the bile specimens was not taken because of its value as an indication of the concentration, for which it is too crude, but merely as a matter of interest in noting the relationship between it and the depression of the freezing point.

Care was taken that all the conditions of the control experiments were duplicated in the diathermy experiments, and vice versa. No results were accepted until the dogs were accustomed to the diathermy applications. During the control periods the electrodes were applied as in the treatment periods, and the machine* started with the only difference that no current went through the animal. All experiments in which anything abnormal took place were rejected as unreliable. One dog developed fever, and a purulent discharge from his biliary fistula a few weeks after his operation, and was promptly discarded and a necropsy performed. He proved to have a purulent cholangitis extending far into the liver, and the microscopic report on a liver section was that of acute purulent hepatitis. All the experimental data on this dog were rejected.

Before the 24 hour periods of collecting were used exclusively, many shorter experiments were done. The first of the longer experiments was one of ten hours. The last of the half hour specimens of the diathermy period was lost, and so the experiment is reported as a 9½ hour period in Table I. The total amount of bile for each experiment shows an increase of nearly 40 per cent after the application of the diathermy, while the depression of the freezing point was diminished in the specimens of the diathermy experiment. The accompanying Graph I-A shows the normal curve of secretion with the curve

* Meat, wheat, codliver oil, sea vegetables, calcium, sodium, and phosphorus. Ox-gall was added in some of the experiments, as noted in the tables.

* The diathermy machines used in these experiments were furnished by the E. J. Rose Company of Los Angeles, California.

Table I.

Exp. 8a and 8b. Dog 2, fox-terrier, male, 22 pounds.

NORMAL			DIATHERMY		
Dog on standard diet, with addition of 16 grains of ox-gall (in capsules) at every meal for 3 weeks, but discontinued 24 hrs. before the experiment. Specimens of normal experiment collected every hour, but reported in $\frac{1}{2}$ hr. specimens.			Diet as for normal. Diathermy to liver region from 10-11 A.M. and 405 P.M. Electrodes 9 by 10 cm., 300-350 mm., wavelength 430 M., 700 Kilocycles. Specimens collected every $\frac{1}{2}$ hr.		
Time	Amount	Depression of Freezing point	Amount	Depression of Freezing point	
9:00-9:30 A.M.	1.50 c.c.	0.77	0.6 c.c.	1.02	
9:30-10:00 "	1.50 "		1.9 "		
10:00-10:30 "	1.50 "	0.77	2.5 "	0.61	
10:30-11:00 "	1.50 "		3.0 "		
11:00-11:30 "	1.70 "	0.71	1.9 "	0.66	
11:30-12:00 Noon	1.70 "		1.2 "		
12:00-12:30 P.M.	1.90 "	0.68	1.7 "	0.65	
12:30-1:00 "	1.90 "		1.0 "		
1:00-1:30 "	0.78 "	0.99	2.2 "	0.70	
1:30-2:00 "	0.78 "		1.0 "		
2:00-2:30 "	1.15 "	0.79	1.8 "	0.72	
2:30-3:00 "	1.15 "		2.4 "		
3:00-3:30 "	1.10 "	0.68	1.9 "	0.87	
3:30-4:00 "	1.10 "		1.5 "		
4:00-4:30 "	1.30 "		3.0 "	0.65	
4:30-5:00 "	1.30 "		1.7 "		
5:00-5:30 "	1.30 "	0.78	1.9 "		
5:30-6:00 "	1.30 "		2.2 "	0.72	
6:00-6:30 "	0.80 "		2.0 "	0.81	
Total:	25.2 c.c.		38.8 c.c.		

as influenced by diathermy, while Graph IB gives the depression of the freezing point, thus indicating the concentration of solids in the different specimens. Rectal temperatures were taken during these experiments, but as the rise in temperature was never greater than 0.4 C., and usually none at all, they are omitted from the tabulations.

In Table II there is an increase in the

biliary secretion of slightly more than 10 per cent for the 24 hours of the diathermy experiment, equal to $2\frac{1}{2}$ hours of extra secretion. During the 12 hour period following directly on the application of the diathermy, a total of 59.4 cc. of bile secreted, as compared with 48.9 cc. during that period in the control experiment, or an increase of nearly 22 per cent. The depression of the freezing

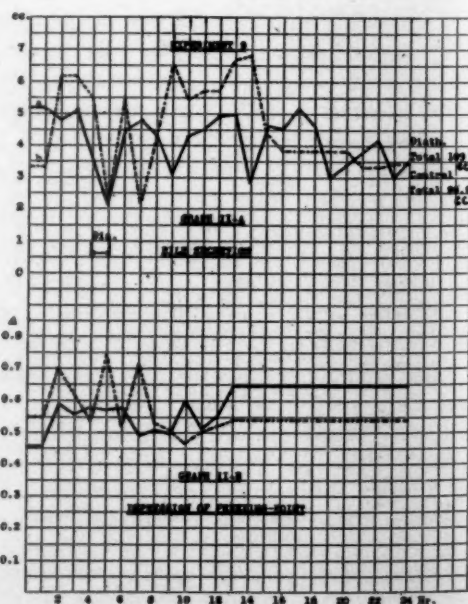
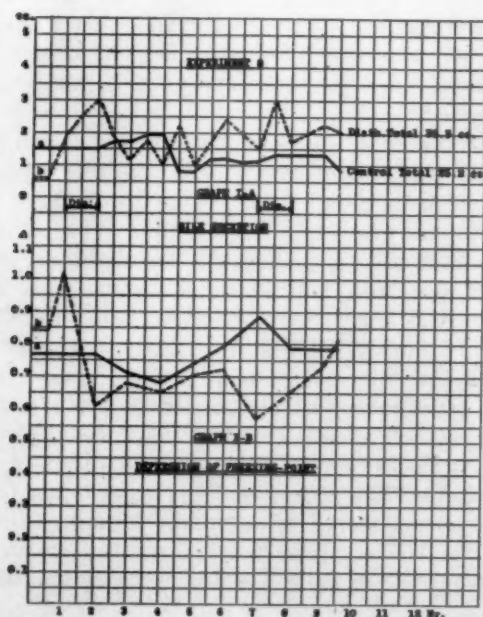


Table II.

Exp. 9a and 9b. Dog 3, Newfoundland (mixture), male, 35 pounds.

NORMAL				DIATHERMY			
Dog on standard diet, with addition of 20 grains of ox-gall (capsules) at every meal for 3 weeks, but discontinued 24 hrs. before the experiment.				Diet as for normal. Diathermy to liver region from 1-2 P.M., 1600 ma., wave length 444 M., 675 Kilocycles. Electrodes 13.5 by 13.5 cm.			
Time	Amount	Depression of Freezing point	Spec. Grav.	Amount	Depression of Freezing point	Spec. Grav.	
9-10 A.M.	5.1 c.c.	0.45	1.016	3.3 c.c.	0.54	1.017	
10-11 "	4.7 "	0.58		6.1 "	0.70		
11-12 Noon	5.0 "	0.55		6.1 "	0.61		
12-1 P.M.	4.7 "	0.57	1.018	5.5 "	0.52	1.016	
1-2 "	2.6 "	0.50		2.3 "	0.76		
2-3 "	4.3 "	0.57		5.5 "	0.51		
3-4 "	4.7 "	0.49	1.018	2.2 "	0.71	1.016	
4-5 "	4.5 "	0.50		4.4 "	0.52		
5-6 "	3.0 "	0.49		6.6 "	0.50		
6-7 "	4.2 "	0.50	1.018	5.4 "	0.46	1.016	
7-8 "	4.4 "	0.50		5.7 "	0.49		
8-9 "	4.8 "	0.55		5.7 "	0.51		
9-10 "	4.9 "	0.53	1.019	6.7 "		1.016	
10-11 "	2.8 "	0.56		6.8 "			
11-12 "	4.5 "	0.62		4.4 "			
12-1 A.M.	4.4 "	0.64	1.019	3.8 "		1.016	
1-2 "	5.1 "	0.76		3.8 "			
2-3 "	4.8 "	0.59		3.8 "			
3-4 "	2.9 "	0.68		3.8 "			
4-5 "	3.3 "	0.73		3.8 "			
5-6 "	3.7 "	0.76		3.3 "			
6-7 "	4.2 "	0.56		3.3 "			
7-8 "	2.9 "	0.67		3.4 "			
8-9 "	3.5 "	0.56		3.4 "			
Total	98.5 c.c.			109.0 c.c.			

point was greater in the normal than in the diathermy experiment, as will be seen. Graphs II-A and II-B illustrate this experiment.

Table III records three experiments. The total amount of bile secreted in each of these experiments shows an increase of slightly

more than 7 per cent with the one hour application of diathermy, and slightly more than 17 per cent with the one and a half hour of diathermy. The twelve hour period beginning with the application of diathermy shows 42.1 cc. for the normal, 45.5 cc. for the one hour

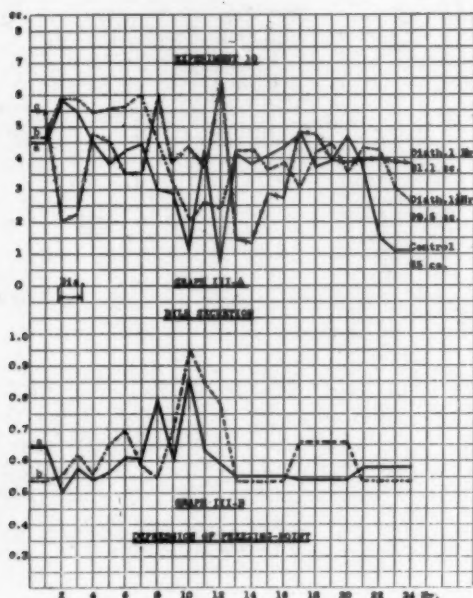
Table III.

Exp. 10a, 10b, and 10c. Dog 3, Newfoundland, male, 35 pounds.

NORMAL (a)				DIATHERMY (b)				DIATHERMY (c)			
Dog on standard diet. (6 ox-gall for 10 days).				Diet as for normal. Diathermy to liver, from 11-12 Noon, 1600 ma., wave length 444 M., 675 Kilocycles. Electrodes 13.5 by 13.5 cm.				Diet as for normal. Diathermy to liver, from 10:45 A.M.-12:15 P.M. 1400 ma., wave length 444 M., 675 Kilocycles. Electrodes 13.5 by 13.5 cm.			
Time	Amount	Depression of Freezing point	Spec. Grav.	Amount	Depression of Freezing point	Spec. Grav.		Amount	Depression of Freezing point	Spec. Grav.	
9-10 A.M.	4.5 c.c.	0.64	1.019	5.5 c.c.		1.017		4.6 c.c.	0.54	1.017	
10-11 "	5.7 "	0.51		2.0 "				5.7 "	0.55		
11-12 Noon	5.4 "	0.57		2.2 "				5.9 "	0.62		
12-1 P.M.	4.5 "	0.54	1.018	4.8 "	0.58	1.017		5.4 "	0.56	1.017	
1-2 "	3.8 "	0.56		4.5 "				5.5 "	0.64		
2-3 "	4.2 "	0.61		3.5 "				5.6 "	0.70		
3-4 "	4.4 "	0.60	1.019	3.5 "		1.017		6.0 "	0.59	1.016	
4-5 "	3.0 "	0.79		6.0 "				5.6 "	0.55		
5-6 "	2.9 "	0.59		3.8 "				3.3 "	0.69		
6-7 "	1.1 "	0.86	1.020	4.3 "	0.60	1.017		2.0 "	0.95	1.020	
7-8 "	4.2 "	0.63		3.7 "				2.6 "	0.84		
8-9 "	0.7 "			6.5 "				2.4 "	0.78		
9-10 "	4.1 "		1.019	1.4 "		1.019		4.2 "		1.016	
10-11 "	3.8 "	0.55		1.3 "				4.2 "	0.54		
11-12 "	4.0 "			2.8 "				3.6 "			
12-1 A.M.	4.3 "		1.020	2.7 "		1.019		3.8 "		1.021	
1-2 "	4.7 "			4.8 "	0.62			3.0 "			
2-3 "	4.7 "	0.054		4.7 "				4.2 "	0.66		
3-4 "	3.9 "		1.022	3.9 "		1.019		4.4 "		1.019	
4-5 "	4.7 "			3.8 "				3.5 "			
5-6 "	3.7 "			3.9 "				4.3 "			
6-7 "	1.5 "	0.58		3.9 "				4.2 "	0.54		
7-8 "	1.1 "			3.8 "				3.0 "			
8-9 "	1.1 "			3.0 "				2.6 "			
Total	85.0 c.c.			91.1 c.c.				99.5 c.c.			

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diathermy experiment, and 52.6 cc. for the one and one-half hour of diathermy, thus giving for the two diathermy experiments an increase of more than 8 and 25 per cent, respectively, for this period. The depression of the freezing point is about equal in the normal and the one hour diathermy experiment, but is definitely greater in the one and a half hour diathermy experiment. Graphs III-A and III-B illustrate these experiments.



In the experiments reported in Table IV there is an increase in the secretion of slightly more than 14 per cent after the use of diathermy. The 12 hour period from the beginning of the diathermy application gives us 34 cc. of bile, as compared with 23.6 cc. in that period in the normal experiment, or an increase of over 44 per cent. The depression of the freezing point is greater in the normal than in the diathermy experiment. Graph IV illustrates the rate of biliary secretion in these experiments.

In the experiments recorded in Table V the diet was altered to the extent that one quart of milk was added to the regular daily ration. The work of Wisner and Whipple⁽¹⁴⁾, Foster, Hooper and Whipple⁽¹⁵⁾, and that of Whipple and Hooper⁽¹⁶⁾, has definitely shown the quantity of bile secreted per day is markedly influenced by the composition of the diet. Whipple and Hooper observed an increase from an average of 59 cc. per 6 hour period on a boiled lean meat diet to 64 cc. when changing to a diet of bread, milk, and bones. The normal used in Table V was the highest normal obtained in our milk diet experiments, all of which were higher than the normals on a diet without the milk. There is an increase in the bile secretion during the diathermy period of slightly over 6 per cent.

Table IV.

Exp. 11a and 11b, Dog 2, fox-terrier, male, 22 pounds.							
NORMAL (a)				DIATHERMY (b)			
Dog on standard diet. No ex-gall.				Diet as for normal. Diathermy to liver, from 1:05-2:05 P.M.; 750 mm.; wave length 444 M; 675 Kilo- cycles. Electrodes 9 by 10 cm.			
Time	Amount	Depression of Freezing point	Spec. Grav.	Amount	Depression of Freezing point	Spec. Grav.	
9-10 A.M.	3.5 c.c.	0.61	1.019	2.8 c.c.	0.76	1.019	
10-11 "	0.7 "	1.09		2.2 "			
11-12 Noon	1.3 "			3.0 "	0.68		
12-1 P.M.	1.4 "	0.99		2.2 "			
1-2 "	1.3 "			6.3 "			
2-3 "	2.0 "	0.65		3.9 "	0.64		
3-4 "	4.6 "	0.75		0.6 "			
4-5 "	2.5 "	0.90		1.4 "			
5-6 "	1.6 "			3.5 "			
6-7 "	1.3 "	0.78		3.3 "	0.70		
7-8 "	0.5 "		1.017	1.0 "		1.020	
8-9 "	0.4 "			4.2 "			
9-10 "	0.5 "			2.4 "			
10-11 "	1.6 "			2.4 "			
11-12 "	3.0 "			2.5 "			
12-1 A.M.	4.0 "			2.5 "			
1-2 "	4.3 "	0.78		2.9 "	0.74		
2-3 "	5.0 "			2.9 "			
3-4 "	3.7 "			3.6 "			
4-5 "	2.1 "			3.7 "			
5-6 "	3.8 "			3.1 "			
6-7 "	4.5 "			3.0 "			
7-8 "	3.5 "			1.8 "			
8-9 "	3.6 "			1.8 "			
Total: 58.9 c.c.				67.2 c.c.			

Table V.

NORMAL (a)				DIATHERMY (b)			
Dog on standard diet, with the addition of 1 quart of milk every 24 hours, started one week before.				Diet as for normal. Diathermy to liver region, from 11:10 A.M.—12:10 P.M.; 1400 ma.; wave length 444 M.; 575 Kilocycles. Electrodes 13.5 by 13.5 cm.			
Time	Amount	Depression of Freezing point	Spec. Grav.	Amount	Depression of Freezing point	Spec. Grav.	
9-10 A.M.	6.2 c.c.	0.56		5.4 c.c.	0.56		
10-11 "	5.2 "		1.016	4.0 "		1.016	
11-12 Noon	1.5 "	0.73		2.2 "	0.52		
12-1 P.M.	2.0 "			6.6 "			
1-2 "	1.0 "	0.76		2.7 "	0.51		
2-3 "	1.9 "		1.017	3.6 "		1.017	
3-4 "	4.8 "	0.51		4.7 "	0.51		
4-5 "	2.7 "			8.1 "			
5-6 "	3.2 "			3.8 "			
6-7 "	4.6 "	0.53	1.017	3.3 "	0.54	1.016	
7-8 "	4.7 "			4.4 "			
8-9 "	4.6 "			4.9 "			
9-10 "	3.8 "			5.0 "			
10-11 "	3.7 "			4.9 "			
11-12 "	5.0 "			5.0 "			
12-1 A.M.	5.0 "			5.0 "			
1-2 "	4.9 "			8.3 "			
2-3 "	4.9 "	0.55	1.016	8.2 "	0.53	1.016	
3-4 "	5.7 "			5.6 "			
4-5 "	5.7 "			5.5 "			
5-6 "	7.0 "			5.8 "			
6-7 "	7.0 "			5.7 "			
7-8 "	5.6 "			5.6 "			
8-9 "	5.6 "			5.6 "			
Total: 106.3 c.c.				126.1 c.c.			

The secretion during the 12 hour period following the beginning of the diathermy was 56.4 cc. as compared with 38.5 cc. in the normal experiment, an increase of slightly more than 46 per cent. The depression of the freezing point was slightly less in the diathermy experiment than in the normal. The curve of the biliary secretion is given in Graph V.

The dogs used in these experiments were carefully examined by necropsy after the experiments were finished. Dog 2 showed a small aberrant duct leading from a separate lobe of the liver, and emptying into the common duct beyond the distal ligature. The common duct was not patent. On the basis of the necropsy findings, the figures for biliary

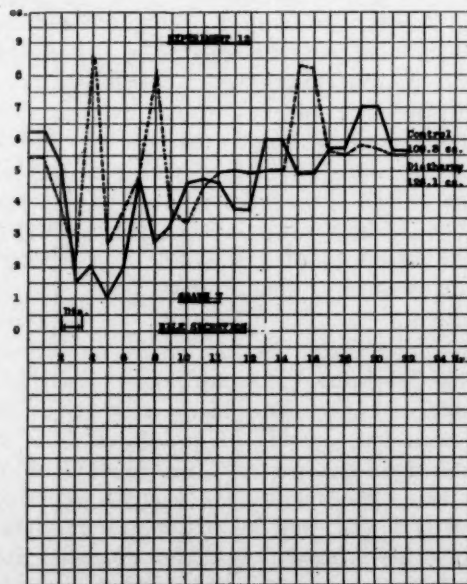
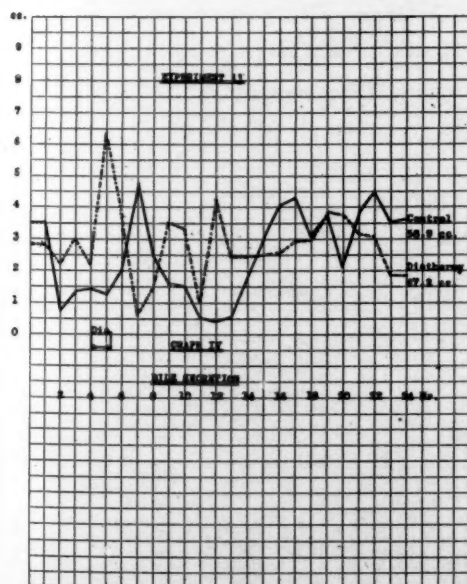


Table VI.

Acute Exp. I. Dog 3, Newfoundland (mixture), male, 55 pounds. Dog was put in ether chamber at 9 A.M., tracheotomy at 9:15 A.M., abdomen opened at 9:25 A.M., canula inserted into common duct at 9:35 A.M. About 1½ K.G. of ether was used before dog died.

Time	Amount	Temperature		Respiration	Pulse
		Rectal	Abdomen		
9:45-10:00 A.M.	0.75 c.c.	36.2	26.0 C.	28	152
10:00-10:15 "	0.21 "	35.6	35.6 "	36	164
10:15-10:30 "	0.01 "	35.0	35.0 "	52	164
10:30-10:45 "	0.02 "	34.6	34.5 "	60	148
10:45-11:00 "	0.01 "	34.0	34.0 "	64	156
11:00-11:15 "	trace	33.6	33.6 "	64	140
11:15-11:30 "	"	33.1	33.0 "	56	156
11:30-11:45 "	"	32.7	32.7 "	48	138
11:45-12:00 Noon	"	32.5	32.5 "	26	160
12:00-12:15 P.M.	"	32.2	32.0 "	56	148
12:15-12:30 "	"	31.8	31.8 "	60	152
12:30-12:45 "	"	31.6	31.6 "	64	156
12:45-1:00 "	"	31.5	31.4 "		

1:00 Dog expired.

secretion as obtained in the experiments on this dog were fully dependable, the small amount of bile which was drained separately by the small aberrant duct being of slight significance either in the normals or in the diathermy experiments. Dog 3, before necropsy, was used also in the second series of experiments; the necropsy showed that there was no escape of bile except by way of the biliary fistula.

B. Second Series

The first series of experiments was performed on more or less normal dogs under as normal conditions as were possible with a biliary fistula. In the second series, healthy dogs were taken and kept under intratracheal ether anaesthesia until they died, the bile being collected every 15 minutes. As soon as the tracheal connection was established, a right rectus incision was made, the cystic duct ligated and the common bile duct laid bare. A slit was made in the duct, a small glass canula inserted, and the duct tied around it, thus obtaining a channel through which the bile could flow to the exterior. The wound was then closed, the dog covered as well as possible, and the collecting of the bile begun. Two dogs were studied in this way without diathermy, and three with diathermy. Where amounts of bile were large enough, the depression of the freezing point was determined.

The dog used in the first experiment (Table VI) was the same dog as used in a number of experiments in the first series. He had been fed, outside of his regular diet, 80 grains of ox-gall per day for ten days before this final experiment. He was in good condition and was used in this acute experiment because his normal flow under normal conditions had been so well established, and the ef-

fect of continuous ether anaesthesia upon his biliary secretion should be clearly demonstrable. As will be noted from Table VI and Graph VI-A, the secretion diminished rapidly and vanished almost completely one hour after collecting began, or one hour and forty-five minutes after the anaesthesia was started. From then until the death of the animal, only minute amounts of bile moistened the receptacle. The temperature went down gradually, characteristic of ether anaesthesia.

As in the former experiment, a continual decrease in biliary secretion is seen in Table VII being almost nil during the last two hours before death, while the concentration of the bile during that time increased. The curve of biliary secretion is found on Graph VI-B.

The three following experiments are similar to the two preceding ones, except that diathermy to the liver was given at some time during the experiment. In the experiment of Table VIII in which there was a diathermy

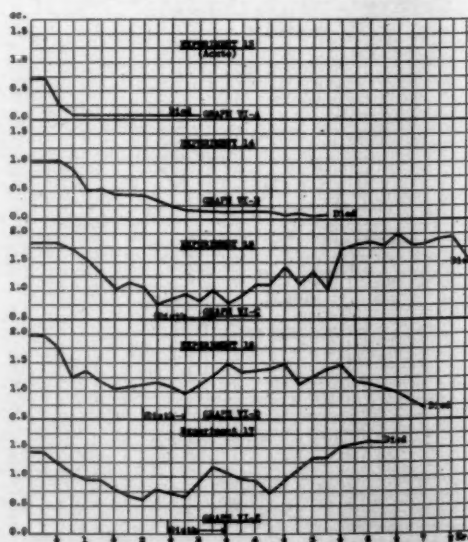


Table VII.

Acute Exp. II. Dog 5, Airdale, male, 28 pounds.

Dog was put in ether chamber at 9 A.M., tracheotomy at 9:15 A.M.,

abdomen opened at 9:30 A.M., canula inserted at 9:40 A.M.

About 2 L. G. of ether was used before the dog died.

Time	Amount	Depression of Freezing point	Temperatures Rectal Abdomen	Respiration	Pulse
10:00-10:15 A.M.	1.01 c.c.	0.56	36.0 36.0 C.	86	160
10:15-10:30 "	1.02 "		35.5 35.5 "	86	160
10:30-10:45 "	0.86 "		35.0 34.9 "	88	160
10:45-11:00 "	0.58 "		34.6 34.5 "	84	160
11:00-11:15 "	0.52 "	0.93	34.2 34.1 "	76	160
11:15-11:30 "	0.36 "		33.7 33.6 "	88	160
11:30-11:45 "	0.35 "		33.3 33.4 "	88	152
11:45-12:00 Noon	0.38 "		33.1 33.1 "	88	140
12:00-12:15 P.M.	0.32 "		32.8 32.8 "	88	120
12:15-12:30 "	0.22 "		32.6 32.7 "	88	160
12:30-12:45 "	0.15 "		32.4 32.4 "	80	140
12:45-1:00 "	0.18 "		32.1 32.2 "	76	148
1:00-1:15 "	0.16 "	1.08	32.0 32.0 "	80	124
1:15-1:30 "	0.10 "		31.6 31.6 "	84	160
1:30-1:45 "	0.14 "		31.6 31.6 "	72	160
1:45-2:00 "	0.11 "		31.5 31.6 "	64	132
2:00-2:15 "	0.10 "		31.4 31.4 "	80	160
2:15-2:30 "	0.06 "		31.2 31.4 "	72	152
2:30-2:45 "	0.10 "		31.2 31.2 "	72	148
2:45-3:00 "	0.06 "		31.2 31.2 "	72	148
3:00-3:15 "	0.09 "		31.3 31.5 "		148

3:15 Dog expired.

application of one hour, a definite increase in the secretion of bile following diathermy is seen, which was sustained until the dog expired. The diathermy was not applied at once in order to observe if the biliary secretion would show the same tendency to a progressive decrease as was noticed in the two control dogs. The general temperature of the dog increased somewhat, instead of decreasing as in the control experiments. The concentration of the bile, as indicated by the depression of the freezing point, stayed about

the same. The curve of the biliary secretion is given in Graph VI-C.

Table IX shows the next experiment and as compared with the control experiments, the 45 minute application of diathermy gave a definite rise in the secretion of bile. There was also a noticeable increase in the dog's temperature during this experiment. Graph VI-D illustrated this experiment.

In the last experiment, as found in Table X, the same tendency to an increased biliary secretion after the use of diathermy to the

Table VIII.

Acute Exp. III. Dog 6, Setter, male, 27 pounds.

Dog was put in ether chamber at 9 A.M., tracheotomy at 9:15 A.M.,

abdomen opened at 9:30 A.M., canula inserted at 9:35 A.M.

About 2 L. G. of ether was used before the dog died.

Diathermy: (to the liver) from 12:05-1:05 P.M., 1800 m.; wave length 444 M. 875 Kilovolts. Electrodes 13.5 by 13.5 mm.

Time	Amount	Depression of Freezing point	Spec. Grav.	Temperatures Rectal Abdomen	Respiration	Pulse
9:45-10:00 A.M.	1.8 c.c.			37.4 37.2 C.	56	124
10:00-10:15 "	1.8 "	0.54				
10:15-10:30 "	1.7 "					
10:30-10:45 "	1.6 "					
10:45-11:00 "	1.3 "		1.015	36.7 36.6 "	72	140
11:00-11:15 "	1.0 "					
11:15-11:30 "	1.1 "	0.56				
11:30-11:45 "	1.1 "					
11:45-12:00 Noon	0.7 "			35.8 35.8 "	74	150
12:00-12:15 P.M.	0.8 "	0.70		36.8 37.4 "		
12:15-12:30 "	0.9 "					
12:30-12:45 "	0.8 "					
12:45-1:00 "	1.0 "					
1:00-1:15 "	0.7 "		1.014	36.4 36.7 "	68	
1:15-1:30 "	1.2 "	0.57				
1:30-1:45 "	1.1 "			36.8 36.9 "	64	
1:45-2:00 "	1.1 "			36.8 36.9 "	66	
2:00-2:15 "	1.4 "			36.9 36.0 "	64	
2:15-2:30 "	1.1 "	0.57		36.0 36.0 "	64	
2:30-2:45 "	1.4 "			36.1 36.2 "	66	
2:45-3:00 "	1.1 "			36.2 36.3 "	66	
3:00-3:15 "	1.7 "	0.56		36.4 36.4 "	64	145
3:15-3:30 "	1.8 "			36.4 36.4 "	56	
3:30-3:45 "	1.9 "			36.4 36.4 "	66	
3:45-4:00 "	1.8 "		1.014	36.5 36.5 "	64	
4:00-4:15 "	2.0 "	0.54		36.6 36.6 "	66	
4:15-4:30 "	1.8 "			36.6 36.5 "	66	
4:30-4:45 "	1.8 "			36.5 36.5 "	66	
4:45-5:00 "	1.9 "	0.58		36.5 36.5 "	66	
5:00-5:15 "	2.0 "			36.5 36.6 "	66	
5:15-5:30 "	1.7 "			36.6 36.6 "		

5:30 Dog expired.

Table IV.

Acute Exp. IV. Dog 7, Airdale, male, 30 pounds.

Dog was put in ether chamber at 9 A.M., tracheotomy at 9:15 A.M.,

abdomen opened at 9:25 A.M., cannula inserted at 9:30 A.M.

About 2½ L.G. of ether was used before the dog died.

Diathermy (to the liver) from 11:47 A.M.—12:32 P.M.; 1600 cm.; wave length 444 M.; 675 kilovolts. Electrodes 13.5 by 13.5 cm.

Time	Amount	Spec. Grav.	Temperatures Rectal Abdomen	Respiration	Pulse
9:45-10:00 A.M.	2.00 c.c.		38.3 38.4 C.	64	136
10:00-10:15 "	1.75 "				
10:15-10:30 "	1.25 "			76	
10:30-10:45 "	1.35 "	1.017			
10:45-11:00 "	1.15 "			80	
11:00-11:15 "	1.00 "			80	
11:15-11:30 "	1.05 "				
11:30-11:45 "	1.10 "				
11:45-12:00 Noon	1.15 "				
12:00-12:15 P.M.	1.05 "				
12:15-12:30 "	0.95 "		40.4 40.9 "	108	145
12:30-12:45 "	1.05 "				
12:45-1:00 "	1.25 "	1.015			
1:00-1:15 "	1.50 "				
1:15-1:30 "	1.35 "			116	
1:30-1:45 "	1.35 "			112	
1:45-2:00 "	1.40 "			104	
2:00-2:15 "	1.45 "			112	140
2:15-2:30 "	1.15 "		40.8 41.0 "	120	
2:30-2:45 "	1.25 "		40.9 41.1 "	128	
2:45-3:00 "	1.35 "		40.9 41.1 "	132	
3:00-3:15 "	1.40 "		41.0 41.2 "	116	
3:15-3:30 "	1.10 "	1.015	41.1 41.4 "	112	
3:30-3:45 "	1.15 "		41.3 41.6 "	100	
3:45-4:00 "	1.00 "		41.3 41.8 "	96	
4:00-4:15 "	0.75 "		41.8 42.2 "	96	
4:15-4:30 "	0.75 "		42.0 42.4 "	88	
4:30-4:45 "	0.65 "		42.3 42.6 "	64	

4:25 Dog expired.

liver is seen as in the preceding two. The temperature also rose after the treatment was given, as compared to the decrease in temperature in the control experiments. The depression of the freezing point increased when the secretion became less, and decreased when the bile became more abundant again, Graph VI-E shows the secretion curve of this experiment.

Discussion

In the first series of experiments the application of diathermy to the liver resulted in a definite increase in the amount of bile secreted during a 24 hour period. We realize that the number of our experiments was comparatively few, and that the increase in the secretion following the diathermy might have

Table V.

Acute Exp. V. Dog 8, Airdale, female, 32 pounds.

Dog was put in ether chamber at 9 A.M., tracheotomy at 9:15 A.M.,

abdomen opened at 9:30 A.M., cannula inserted at 9:35 A.M.

About 2½ L.G. of ether was used before the dog died.

Diathermy to liver region, from 12:50-1:40 P.M.; 1700 cm.;

wave length 444 M.; 675 kilovolts. Electrodes 13.5 by 13.5 cm.

Time	Amount	Depression of Freezing point	Spec. Grav.	Rectal Temp.
10:00-10:15 A.M.	1.40 c.c.			38.9 C.
10:15-10:30 "	1.20 "	0.76		
10:30-10:45 "	1.00 "			
10:45-11:00 "	0.90 "			
11:00-11:15 "	0.95 "	0.82		
11:15-11:30 "	0.75 "			
11:30-11:45 "	0.65 "		1.017	38.3 "
11:45-12:00 Noon	0.60 "			
12:00-12:15 P.M.	0.75 "	0.86		38.0 "
12:15-12:30 "	0.70 "			
12:30-12:45 "	0.65 "			37.9 "
12:45-1:00 "	0.90 "			
1:00-1:15 "	1.20 "	0.68		41.0 "
1:15-1:30 "	1.10 "			42.0 "
1:30-1:45 "	0.90 "			42.2 "
1:45-2:00 "	0.95 "			42.2 "
2:00-2:15 "	0.70 "	0.65		
2:15-2:30 "	0.95 "			42.4 "
2:30-2:45 "	1.15 "			
2:45-3:00 "	1.35 "		1.016	
3:00-3:15 "	1.35 "			42.6 "
3:15-3:30 "	1.55 "	0.67		
3:30-3:45 "	1.60 "			
3:45-4:00 "	1.70 "			45.1 "
4:00-4:08 "	0.85 "			

4:08 Dog expired.

been more striking if more than one control period had been used for each diathermy experiment. Yet, previous work of other investigators has convinced us that under the same conditions and on the same diet the total output of bile during a 24 hour period varies but very little either in man or dog. Pfaff and Balch⁽⁹⁾ in their work upon a patient with biliary fistula found less than 5 per cent difference in the output of the three consecutive 24 hour periods which preceded their experiments with chologogues. The last three days of their observations, when no drugs were given, a difference of less than 2½ per cent was found in the daily excretion. Whipple and Smith⁽¹⁷⁾ repeatedly found as little as 1 cc. difference between successive 24 hour bile collections, when the dog was kept on the same diet. Smith, Groth, and Whipple⁽¹⁸⁾ noted uncontrollable fluctuations in their 8, 12, and 24 hour collections, but they explain this by the appearance of "kinks where the canula is tied into the bile duct, or by bits of mucus or precipitate forming a plug" which temporarily slowed or obstructed the flow through the tubing. Wisner and Whipple⁽¹⁴⁾ found only a few cc. difference in the secretion of 24 hour periods when the diet had been the same for a number of days. In their summary they state: "Bile fistula dogs will show little if any difference in the output of bile, bile salts or bile pigments during four consecutive 6-hour periods."

When considering the second series of experiments as a whole, we cannot but be impressed by the consistent rise in biliary secretion whenever diathermy was applied, as compared with the progressive fall in the secretion of bile when no diathermy was used, or before it was applied. One might say that this could be due to a great extent to the increase in the general temperature observed in those dogs which received diathermy; that would hardly account, however, for such a marked effect on the biliary secretion, especially when one considers the fact that the increase in the secretion of bile was most marked in Acute Exp. 15, when there was an increase in the body temperature of only about 2 degrees. This was decidedly smaller rise of temperature than in the other two dogs, which showed a less marked rise in their biliary secretion in spite of their higher body temperature.

The work done so far is only small in amount, and there is need of more clinical

and experimental data upon the influence of diathermy on the normal and diseased liver. If our work, and the clinical experience of others, is further corroborated, the high frequency current should find a greater use as a therapeutic agent in certain of the diseases of the liver.

Summary

In the first series of experiments the effect of diathermy upon the secretion of bile was studied upon dogs in which biliary fistulae had been produced. Diathermy to the liver gave an increase in the secretion of bile ranging from 7-17 per cent during a 24 hour period. The increase in secretion during the 12 hour period immediately following the application of diathermy varied from 8-46 per cent. The depression of the freezing point in the bile specimens diminished usually when the secretion became more abundant, but this was not constant. At times the depression of the freezing point increased with an increase in the quantity of bile.

In the second series of experiments the influence of diathermy upon the biliary secretion of dogs which were under continual ether anaesthesia was studied. It was found that diathermy to the liver caused an increase in the secretion of bile as compared with a decrease prior to the administration of the diathermy or as compared with an all but complete suppression of the secretion in those dogs which received no treatment.

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SOME PROBLEMS OF ELECTROPYREXIA *

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By electropyrexia we mean a form of treatment which is also known as electric pyretotherapy, the diverse technics of which have been originated in the United States. These technics are variably described as radiothermy by short waves (Carpenter and Whitney), diathermy (Neymann), and a comparatively new method of utilizing infrared in an atmosphere saturated with water vapor, with which we have had no experience.

Our statistical data have been published in France and as they are practically in accord with those published in the United States, we shall omit them in this article. Considering, however, that recent researches by Freeman and Rosenberg apparently contradict the published results of the treatment of general paralysis, it is timely to discuss some of the biologic and therapeutic problems of electropyrexia.

We know that heretofore fever therapy has been employed empirically. Numerous pyretogenic agents have been employed, which in itself shows that there were imperfections, such as difficulty of manipula-

tion, certain risks, etc. The rather crude methods of producing artificial fever often resulted in unanticipated reactions, occasionally mild in intensity but some times extremely severe. Nor can it be said that the therapeutic indications were always exact. One often was not even sure of actually affording the patients pyretotherapy. As an illustration we need only point out that in malariatherapy a number of authors considered the presence of the plasmodium indispensable. They based this assertion on observations of cases of remission of general paralysis following attacks of paludism which were virtually apyretic. Shock effects exclusive of the specific character of the agent employed, too, have been regarded as part of pyretotherapy. On the other hand the varying degrees of favorable therapeutic effect through the production of increased bodily temperature strongly pointed to the rationale of fever therapy, especially with more perfect methods of procedure.

In high- and in ultra-high frequency currents we have an agent for pyretotherapy that is not only easy of application but reliable and under constant control. Fever

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can be produced at will whenever desired, its intensity and duration regulated, and the treatment repeated as needed. The important question that suggests itself is, whether the fever produced by this method is due to the application of heat or to factors resembling those observed in infectious pyretotherapy.

In spite of the complexity of the functional phenomena in spontaneous fevers, they can be divided into two groups so far as they relate to pyretotherapy:

- (a) vascular modifications, and
- (b) humoral modifications.

Let us now compare the action of spontaneous fever with that produced by the high frequency current with reference to the above two groupings.

Vascular and Humoral Effects

In spontaneous fever, in which the organism itself causes the rise of temperature, vasodilatation affects principally the deep-seated organs (visceral and muscular). It corresponds to a general increase of metabolism. The peripheral circulation on the other hand, in order to afford maximum cooling, remains practically normal, at least during the rise of temperature.

In artificial fever, it is the peripheral circulation that bears the brunt, in order to assure the cooling of the organism, struggling against an abnormal rise of temperature. It manifests itself by a very pronounced congestion of the tegument and the mucous membranes. As regards the deep-seated circulation, the question is of the greatest importance on account of the applicability of the method to deep-seated circulatory troubles and to maladies of nutrition. Unfortunately this has not as yet been settled.

Certain authors have considered that this pronounced peripheral vasodilatation should be compensated by a deep-seated vasoconstriction, a veritable compensating and modifying effect, which assures: 1. Relief of the work done by the heart; 2. diminution of metabolism through the cooling of the organism. There is record of marked ischaemia of the lobes of the brain, observed during the autopsy of patients affected with general paralysis, who died during the course of hyperpyrexia treat-

ment. The majority of investigators have confirmed our own findings; namely, that there occurs a constant congestion of all the viscera, including the brain, and even, in the case of a particularly abrupt heating, extensive hemorrhage follows capillary rupture.

We may further state that metabolism is not reduced, since, in normal subjects, during the course of each sitting, the basal rate is almost always increased 20 to 30 per cent; that is, within limits which the peripheral vasodilatation alone will not suffice to explain. In summarizing this phase of the subject, which obviously merits more detailed discussion, we conclude that we shall arrive at a definite conclusion only when we shall have perfected the methods of estimating the circulatory output, which are insufficient at the present time.

What we have just stated concerning the vascular modifications occurring during electropyrexia is not surprising, since they represent, with some variations, the segmentary modifications of the circulation resulting from gradient heating. What they afford us, if the supposition of deep-seated vasodilatation be confirmed, is the possibility: 1. Of the heating of deep-seated organs which have hitherto been inaccessible to diathermy (brain, mediastinum, etc.); 2. of a simultaneous heating of several organs (in particular the simultaneous causes and action upon the endocrine glands).

What becomes of the humoral reactions in spontaneous fevers? It is quite surprising to observe that they practically run a similar course as that of the vascular system. American authors must be accorded the honor of having been the first to study one of the most important of these, that of the blood formula. It consists above all in an increase of the leucocytes, and especially of the polynuclear neutrophiles.

We have examined by parallel studies, the modifications of the flocculent power of the serum of subjects treated by electropyrexia for a certain number of microorganisms. Augmentation of the flocculent power, in human pathology as well as experimentally (whose study has been the subject of a detailed communication made to the Congress of Electro-radiology of

Paris, last October) is practically constant and extremely well-marked. Moreover, the variations in the amount of the flocculation follow almost exactly those of the temperature, and are more apparent when the latter is higher. In subjects whose serum, during subfebrile affections, has already a flocculent power, diathermic heating still further diminishes the amount of flocculation.

These simultaneous modifications of the blood formula and of the defensive properties of the serum, are of the greatest importance. They justify the use of electropyrexia for infectious maladies which are apyretic (syphilis) or even subfebrile. They may also, from a more general standpoint, lead us to modify our ideas regarding the determining conditions of spontaneous fever. Above all, they lead us to an important question, that of technic. They show us that diathermic fever is not a simple therapeutic action, but that on the contrary it secures, like that of spontaneous infectious fevers, of which it appears to be a near duplication, the complexity of the means of defense which these latter employ. And it is because we have a controllable means of pyretotherapy, whose essential quality is that it can be readily adapted, we should now seek to employ it methodically.

Problems In Electropyrexia

Without considering the question of the specific action of the currents employed (quite recently d'Arsonval laid stress upon this point), there remain a great number of problems whose solution will guide us in the methodical utilization of electropyrexia. It would appear, for example, that we should confine ourselves, for the treatment of general paralysis, to the method described by Neymann, Carpenter, Hinsie, and Bierman. But is it necessary to apply these heavy doses, which are not without danger in the treatment of a rheumatism, in which we only seek to modify the conditions of the circulation? To what are due

the transformations of the specific lesions under the influence of heat? Is the treponema subjected to a veritable "cooking" (Bessemans), and in that case, is there a minimum temperature to be reached? Are the conditions of existence of this treponema strongly modified by the heat *in vivo*, as they are *in vitro*? Or does the high temperature set up an intense humoral action by calling out the defenses of the organism? What then should be the length and the number of the treatments?

In the treatment of endocrine affections, are we also to use high fevers? Is not the duration of the séances more important here than their intensity? The form of treatment required in general paralysis comprises contraindications and dangers which do not exist for the fevers which are less high and less prolonged, and which perhaps will be sufficient in most cases. If, in malariatherapy of general paralysis we seek to reproduce attacks of paludism, should we not, in the case of dementia praecox sometimes ameliorated by an intercurrent typhus, seek to reproduce the long horizontal curve of the temperature in this malady?

Is it not necessary from now on, frequently to employ therapeutic measures which are associated and simultaneous, physical or chemical? During fever the activity of medicines, sensitiveness of the tissues to radio-active substances and to the x-rays, are increased, and similarly there are great possibilities also open to electropyrexia.

We now possess a means for pyretotherapy which has extraordinary flexibility. New and recent modifications of our French instruments promise to render electropyrexia still more reliable, more rapid, and less expensive. Contrary to the empiricism of the other methods of pyretotherapy, electropyrexia shall become a precise therapeutic method based on true science.

THE "MICRO-DYNAMETER"

An Alleged Detector of Disease and Therapeutic Indicator

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The welfare of our patients and a spirit of fair play in the scientific world demand that any reasonable effort towards the improvement of our diagnostic and therapeutic methods be accorded a hearing. For the same reasons it is equally desirable to expose all pretensions, especially those presenting unfounded claims as scientific facts.

There has lately appeared on the market a machine or appliance which is being sold to physicians under the high-sounding name of "Micro-Dynameter," for which its inventor, Mr. F. C. Ellis, an electrical engineer, makes astounding claims. According to the advertisements this machine enables every physician to make diagnoses in a few minutes in cases which with our present clinical and laboratory methods would require hours or days of painstaking study and observation. For the same instrument a claim is made that in some mysterious sort of a way it also can serve as a guide to the proper therapeutic procedure to be followed in a given case. I would have ignored the entire business as too preposterous to be seriously considered by any one physician with a scientific grounding, were it not that the inventor has seen fit to provide his salesmanship with an ostensibly scientific background, which in reality is no more nor less than camouflage. Mr. Ellis has seen fit to misapply for his pseudo-scientific background certain expressions loosely garbled from the writings of McDonagh, of London, the foremost exponent of the relation of colloidal phenomena of the blood to disease. As one who happens to be familiar with McDonagh's work, I am prepared to state that Mr. Ellis might with equal logic have based his claims for his machine on the writings of General Pershing as on those of McDonagh. Stripped of all verbiage Ellis' "Micro-Dynameter" is a nondescript electrical contraption in the literal sense of the word, bolstered up for sale at an incredibly high price by preposterous claims which it will be easy to relegate to a place where they belong.

Mr. Ellis is undoubtedly a physicist who is familiar with certain phases of medical literature.

To begin with, the general arrangement of his diagnostic test differs little from the hook-up that had been used by others to determine certain features of the psychogalvanic reflex. His arrangement consists of a copper and a zinc plate acted on by the patients perspiration, while a Leclanché element with a better contact was used by scientific investigators. Mr. Ellis' "originality" has evidently completely flabbergasted the reviewer in the periodical *Clinical Medicine and Surgery* in which monthly, Ellis carries an advertisement. It is perhaps more than a coincidence that much of similar nonsense has been published about 16 years ago in A. White Robertson's "Studies in Electro-Pathology."

Mr. Ellis must be given credit for a sense of the esthetic, for he advertises his contraption — I find no better designation for his appliance — by numerous artistic photographs and does not fail to advise us that his creation or rather parts of it have a silver satin finish. He fails to give, what we are accustomed to find in the catalogues of reputable firms, an accurate description of the physical constants. Taking for purpose of illustration an advertisement of a galvanometer costing \$15.00, we find in part the following data: Sensitivity 0.5 microamperes per mm., period 3 seconds, coil resistance 1,000 ohms, external critical damping resistance of 2,400 ohms. These are scientific data conveying desired and understood information to any one who has to make use of a reliable galvanometer for no matter what scientific purpose. One looks in vain for such clear and accurate data in Mr. Ellis' 95-page book, "Micro-Dynamics," describing a contraption offered to the purchaser for no less than \$1,185! And yet the inner resistance of the galvanometer influences its characteristics as a measuring instrument. In the case of the "Micro-Dynameter" it determines whether the deflection is a rough

measure of the past and present perspiration and the humidity of the air alone, or whether other factors, such as flat feet, also influence the result.

The key to the correct understanding of Mr. Ellis' contribution to medicine may be found on page 11 of his book. According to him, an inventor has "*the prerogative of deliberately camouflaging his invention in order to deceive his detractors and imitators.*" (Italics mine.) He tactfully refrains from mentioning the customers, although it is evident that they or their unfortunate customers form the bulk of the people to be deceived by this "inventor's prerogative." It must be obvious to all except the most puerile of the customers that it would take an electrical engineer only a few hours to take the contraption apart and duplicate — not merely imitate — it.

It is a proper job for a detective to try to pick out from his book what he purports to be measuring in terms which have a physical meaning. I would have to quote from four pages and Mr. Ellis still could wriggle out of it by an invention of another of the inventor's prerogatives, namely, that of using new and absurd definitions for old and clearly defined terms (for instance that of the hydrogen ion concentration). Fortunately, however, the "Progressive Advertiser's Department" of *Clinical Medicine and Surgery* has blossomed in the last few months into a veritable postgraduate course in this kind of business. I quote the following statement from its September (1933) issue: "Colloids are profoundly affected by slight changes in the concentration of electrolytes in the suspension media. By utilizing the human body as an electrolyte to form a simple electrical cell, the Ellis' Micro-Dynamometer measures these slight electrical changes in the body. "Translated into the language of physics, this means that Ellis claims to measure the conductivity of the electrolytes of the body. Ellis himself mentions that the cells "by-pass" small currents, and he knows, therefore, that only the blood plasma and the tissue fluid conduct the current in the body. He knows that their conductivity differs only little, he knows that it varies only little even in pathological conditions and he also knows that such changes as occur, do not influence demonstrably the condition of the plasma colloids. Such an effect is possible with changes of mutual proportion of the electrolytes without altering the conductivity of

the plasma. This claim at once dissociates Ellis from the start from McDonagh, who holds the opposite view, namely, that the condition of the plasma colloids influences the concentration of the electrolytes and even of the nonelectrolytes in the plasma.

Since Mr. Ellis claims to measure something which the physicist would call the conductivity of the blood plasma and tissue fluid, we could stop right here and say that so far there is no evidence of its practical value — to say nothing of it as an index of "vitality." Furthermore we could say that the conductivity can be measured directly. But that is not accurate enough for Mr. Ellis, because it is measured *in vitro*. Let us examine the accuracy of his procedure.

In the beginning of the performance, the patient stands on a presumed clean zinc plate and grips with his hands a presumed cleaned copper cylinder. Here for once the inventor states a fact: The electrodes plus the patient represent a voltaic cell and the beam of light is the indicator of a nondescript galvanometer. We are not told how many microamperes or perhaps millivolts each division represents. Mr. Ellis apparently does not care to burden the minds of the scientists whose help he enlists with such minor details. All they need to know is, that they are getting "on a calibrated scale" an "accurate scientific quantitative test of vitality."

In spite of the absence of the data on the constants of the contraption, it is not difficult to analyze three possibilities of the arrangement: In any circuit, the strength of the current (Ampères) is directly proportional to the electromotive force (Volts) and inversely proportional to the resistance (Ohms). The formula is:

$$\text{Current} = \frac{\text{Electromotive Force}}{\text{Resistance}}$$

The resistance of a circuit, such as we have here, can be divided into two parts: First, the resistance in the Voltaic cell represented by the electrodes and the patient, we designate as "Pat." Second, there is the resistance of the measuring contraption, which we designate as "Crp." Thus the formula will be:

$$\text{Current} = \frac{E. F.}{\text{Pat.} + \text{Crp.}}$$

It is obvious, that if the resistance of the

galvanometer is very large compared with the resistance of the cell, the formula will be practically equal to:

$$C = \frac{E. F.}{Crp.}$$

This means that the only thing measured in such a case is the electromotive force, which is determined by the position of copper and zinc in the electromotive series and by the concentration of the electrolytes — mainly sodium chloride — in the sweat, and also slightly by the difference of their concentration on each electrode. This latter difference, by the way, would be the main determining factor of the Ellis' polarity test, if it were done with scientific precautions. This is another of the performances executed with the contraption: one electrode is placed on the forehead and the other is split in two, each hand touching one of these halves and the illuminated dial showing the "polarity." We owe to Ellis the discovery that the percentages of positive, negative and neutral polarity are strikingly different in New York, Chicago and Des Moines, Iowa. Apparently no attempt was made to find out whether this is due to a slight difference in the composition of the electrodes touched by the fingers — such as a layer of oxide or dirt on one of them — or a higher resistance in one lead. A difference in climate is *a priori* accepted as an explanation by Ellis and his research associates, since it is funnier.

With a high resistance in the contraption, the deflection of the galvanometer amounts to a poor measure of past and present perspiration, or at least it was that originally. However, according to an article which appeared in the October (1933) issue of *Clinical Medicine and Surgery*, a change in the technic has taken place: The patient's skin is now being "carefully prepared." The details are apparently another trade secret and would matter only in a scientific method, since they may add more uncontrolled variables. The sad thing is, that no matter whether this "careful preparation" consists of washing or rubbing, it removes the patient's past perspiration as surely as if he had taken a bath. Consequently Mr. Ellis can no longer claim that his vitality test gives "in one mass chord the algebraic sum of all the forces or "what not" which had affected the sucker through life. The most important of these "what nots" of Mr. Ellis was obviously the time that elapsed since the

last bath. And now I find that he has removed just this one factor actually related to health from the variables which determine the reading of his "precision instrument."

The second possibility is, that the resistance of the contraption is so small, when compared with the patient's resistance, that the formula can be written:

$$\text{Current} = \frac{E. F.}{\text{Pat.}}$$

The third possibility is in between, and so are the results.

Let us examine what factors determine the deflection of the galvanometer in these cases — besides the electromotive difference between copper and zinc, which is constant and therefore may be disregarded, and their cleanliness (dirt and oxide) which is variable and could not be disregarded in a serious arrangement. Let us also see whether the components of the inner resistance — or conductivity — of the copper — patient-zinc element are constant or variable. And if they are variable, let us see how much they can influence the professed aim of the reading — the determination of the conductivity of the electrolytes. To give you an example, let us assume for a while that some other scientist has made a discovery which really equals in importance Mr. Ellis' fundamental truth about the identity of the concentration of the electrolytes and the vitality. Such a discovery would be for instance the claim that the weight of the shoes is an "accurate scientific measure of the vitality." One might think that in such a case, the simplest thing would be to take off the shoes and weigh them. Here the inventor steps in and, using his prerogatives, says: You forget that they have to be weighed as they are on the patient. If he takes them off, some of the natural moisture will evaporate and the weight will be off by several milligrams. Besides, it takes too much time to take off the shoes. I will sell you my precision scales, which are similar to those used in coal yards, but accurately calibrated to show the weight of the shoes. You place them in front of your house and the patient will drive with his car on them. Since he has his shoes on while driving and the scales are calibrated for them, the illuminated dial will tell you in twenty seconds his vitality. It is easy for every one to see that it is absurd to pretend to weigh the shoes with their variation of ounces and

to disregard the weight of the car with its variation of tons. It is surprising that none of the philanthropists duped by Ellis' machine seem to have even suspected that a similar proportion exists between the variations of the conductivity of the body fluids which Mr. Ellis tells them they are measuring and the variations of all the other factors, which actually determine the reading. And, incidentally, they do not suspect that there is just as much evidence for declaring the shoes to be a measure of vitality as there is for regarding the deflection of the Micro-Dynameter as a vitality index.

The major variables which determine this deflection are:

(1) and (2). The amount of moisture between the skin and the electrodes due to the humidity of the air and the rate of perspiration which means two disregarded variables in one stroke. If you do not realize this, you will, if you place a dry and a moist finger in an electric socket.

(3). The concentration of salt on the skin.

(4). The resistance of the skin itself — a very important variable.

(5). The polarization due to the use of a direct current for measuring the electric conductivity — a real *novum* in physics even without the additional trouble of measuring it across physiologic membranes. This factor has been investigated and found to depend on the activity of the sweat glands. It is therefore influenced by emotion and has been utilized years ago under the name of psychogalvanic reflex. (Tarchanoff, Veraguth, Gildemeister, Leva, et al.). Such a reflex will increase the deflection, when the contraption is used for localization of lesions, if the exploring electrode touches a sore spot. I believe that a less expensive method would be either acoustic — to listen, if the patient yells or, visualize — to notice if he makes a face.

(6). The area of the electrodes in contact with the skin. It is, of course, conditioned by several important manifestations of vitality, such as the size of the hands and the flatness of the feet. If the resistance of the contraption is small enough, the distressing combination of flat and perspiring feet will affect the pointer as much as it will any close social gathering.

(7). The length of the path traversed by the current in the body depends on the length of the extremities and of the trunk. Imagine

a child and an adult! This is the only variable which may be partly counteracted by another variable; namely, taller people have frequently larger hands and feet, although there is no direct proportion.

(8). The width of the path of the current in the body — the cross section of the channels of the fluid part of the blood and lymph.

(9). The last variable is the one which Ellis designates as the "index of vitality," which he purports to measure, if we discount all the verbiage explainable by the inventor's prerogative of fooling the sucker. It is the conductivity of the body fluids — the blood plasma and tissue fluid. While Mr. Ellis serenely disregards at least eight important variables, it is precisely this one which we may safely disregard in his arrangement, since its variations are too small to be estimated in that way. They disappear when compared with the variations due to the height of the patient alone. Moreover, the conductivity of the plasma can be measured directly, and that has nothing to do with the vitality nor with the condition of the plasma colloids, so far as evidence goes. Almost every one of the variables which determine the deflection can be measured and has been measured and evaluated separately. Now comes Mr. Ellis and recommends an uncontrollable jumble of all of them as a scientific test.

I may add something about the further uses of the contraption aimed at chiropractors and the disciples of Abrams. Contrary to Mr. Ellis' assertion, reflex zones have been known and investigated long before Abrams, who only added the abdominal zones indicating the religious — and I forgot if also the political — affiliation of the suckers, besides their inherited syphilis. It is true, as Mr. Ellis aptly points out, that these claims have never been impartially investigated. It is well known that differences in the number and activity of the sweat glands are present in different parts of the body and that a psychogalvanic reflex will be produced by touching a sore spot. This can be done with less expensive outfits and better. Yet if he limited his claims to that and gave an honest description of his machine, there would be no reason to object, but with the dirt eliminated, the pay dirt, or, as he calls it, the basic soil struck by him, would disappear.

In addition to the diagnostic uses of the contraption, Mr. Ellis felt constrained to in-

vent the logical basis for a new and better range of therapeutic currents to be administered by it. This logical basis is, of course, the body current. And what is the body current? The current produced from zinc and copper by more or less perspiring extremities and conditioned by all the other factors, such as the flat feet of which I spoke. No sensible reason is given, why and how this is used as a basis for therapy. The main thing is, that danger can be avoided and fine results obtained only by dispensing these minute currents from the Micro-Dynameter according to a blue print, which takes due notice of the effects of the time elapsed since the last bath on the pointer of the illuminated scale and of the amount of grease and oxide on the electrodes, which is the main factor in the Ellis polarity test. It could not be done with a flashlight battery costing a dime.

Mr. Ellis, who so fervently wishes for a chance to have his invention tested objectively and scientifically, knows very well that this is impossible for the men he approached if he withholds from them the information about the physical constants of his contraption and about their significance and the variables discussed above, most or all of which he is certainly familiar with. Posing as an alleged victim of the notorious narrowmindedness of medical leaders, he enlists the sympathy of people who do not realize that it is he who

very effectively prevents them from investigating his claims scientifically and he certainly knows why. This method resembles very closely the ancient supreme principle of the medicine show men: "Never give the sucker a break," which is, of course, only a simpler expression of "the inventor's prerogative to camouflage in order to deceive," which Mr. Ellis invented. It was, perhaps, too great a temptation to find out how far he can go with people, who would swallow his statements that no electrical current is conducted into the body while the electrodes touch it and the galvanometer shows a deflection. His sense of humor is most evident in his discovery that the serum — not the electrodes — acts as an electrolytic rectifier and in his explanation of the difference in the polarity of suckers in New York, Chicago, and Des Moines, Iowa. He does not need all this nonsense for his contraption any more than he needed to invent his "Dynamic" forces, but he either wants to distract the attention from the fundamentals, which he avoids, or simply enjoys making fun of the good people, who take him seriously, so much, that he rather takes a chance with a critic than forego that pleasure. In this endeavor he would have my sympathy, if I did not realize that the cost of this fun is borne by the patients.

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LARYNGEAL TUBERCULOSIS

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The literature on this subject is so prolific that one feels apologetic for reading another paper without adding anything except a few of his own observations. But when we realize the accomplishment of our labor and see the change in the attitude towards this disease by the patient as well as by the physician, one cannot refrain from speaking enthusiastically whenever an opportunity presents itself.

In 1837 Trousseau and Belloc⁽¹⁾ won the prize offered by Paris Academy for the best definition and description of laryngeal phthisis. They defined the disease as "*tout alteration du larynx, pouvant amener la consommation ou la mort, en quelque manière que ce soit*," which literally means, every alteration of the larynx, which brings consumption or death no matter what you do.

Only a few years ago, the common saying among the consumptives was — "When you get the T. B. in the larynx, there is no more hope and death must ensue." The physician as a rule held no more optimistic view than to inject alcohol in the superior laryngeal nerves to make death easier for the patient. Today they all regard laryngeal tuberculosis as an ordinary complication to the pulmonary affection expecting to get good results by treatment.

Laryngeal tuberculosis was mentioned by Hippocrates⁽²⁾ about 400 B. C. When he alluded to "ulcers in the tube of the lung," it may justly be inferred that he had some conception of the disease as it appears in the larynx. But no advance was made until 1825, when Mathew Baillie⁽³⁾ described the different forms of tuberculosis found in the larynx and trachea. Real progress followed the introduction of the laryngoscope by Manuel Garcia⁽⁴⁾ in 1855. Clinical diagnosis was then made possible. In 1879 Oscar Heinze⁽⁵⁾ demonstrated that tuberculous infiltration of the mucosa was the sole cause of laryngeal and tracheal tuberculosis.

For a long time after that, tuberculosis of the larynx was regarded as a separate entity, like bone and joint tuberculosis and treated as such irrespective of the condition of the lung. But with the advent of the newer methods of

diagnosing tuberculosis of the lungs as well as other parts of the body, no one could safely claim tuberculosis of the larynx to be a primary condition. The few isolated cases which have been reported as primary lesions of the larynx proved by biopsy and with no evidence of tuberculosis elsewhere in the body, cannot be accepted as final without the benefit of a post mortem and microscopic serial slide examination of the chest. Osler⁽⁶⁾ mentions the group of cases in which throat and larynx symptoms precede the pulmonary lesions, as a very important one. R. Stevenson⁽⁷⁾ cites four cases in whom incipient tuberculosis was found in the lungs only after repeated examination of the chest, after the larynx lesion was well manifested. Such a case has come under my own observation.

E. T., aged 51, male, merchant, May 18, 1920. Complaint: Hoarseness for several months, no pain or discomfort. Physical examination as well as x-ray proved to be entirely negative, except for a fair sized irregular mass, pale in color, filling out the interarytenoid sulcus; no ulcerations. Biopsy revealed the mass to be a tuberculoma. Cautery removed it without recurrence. In 1930, ten years later, the patient developed pulmonary tuberculosis with hemoptosis and cavitation, from which he has not yet recovered.

Pathogenesis

On the other hand not all lesions in the larynx occurring in tuberculous patients must be tuberculous. In another paper⁽⁸⁾, I cited a case of a carcinoma of the larynx occurring in a tuberculous patient which I removed by laryngo-fissure three years ago with no recurrence, but the patient is at present at a sanatorium still seeking the cure for his pulmonary affection. Tucker⁽⁹⁾ and MacKenty⁽¹⁰⁾ reported similar cases. I also found a syphilitic lesion in a tuberculous patient which was proved by a Wassermann test and therapeutic reaction. Looper⁽¹¹⁾ and Thost⁽¹²⁾ describe a number of such cases of the coexisting diseases.

Laryngeal tuberculosis as a complication to pulmonary tuberculosis occurs next in frequency to tuberculous enteritis and colitis. According to Rubin⁽¹³⁾, two out of every three persons dying of pulmonary tuberculosis

showed intestinal ulcers, while 50 per cent showed tuberculous involvement of the larynx at autopsy. As not all tuberculous patients die of pulmonary tuberculosis, we find 25 per cent a more conservative figure of laryngeal involvement in all tuberculous patients occurring somewhat more frequently in men than in women.

In the Maryland State Sanatorium the percentage runs about fifteen, while in ours, The Mount Pleasant Sanatorium, a private institution of Baltimore City, where the patients are kept for several years, and then followed by a field worker for many more years thereafter, the percentage runs about twenty.

We cannot deny the hematogenous or the disputed lymphogenous origin of laryngeal tuberculosis, as it is presented by Safranek⁽¹⁴⁾, Aubry and Brodiesz⁽¹⁵⁾, and others. Clinical evidence shows about one-fifth of the cases occurring in patients with so-called closed lesions of the lungs where no bacilli can be demonstrated in the sputa. But by far the great majority of cases are directly inoculated by sputum loaded with bacilli coughed up from the lungs. Whether the bacilli have the power to penetrate normal mucous membrane or not, the larynx very frequently presents small erosions and abrasions where the bacilli may easily lodge and set up an irritation. There the deposits of tuberculous material in the larynx produce different effects according to the resistance of the tissues; the biological immunity of the body in general; the allergy of the invaded part, and the virulence of the infection present. When hematogenous or lymphogenous in origin, the body in general offers a good resistance; there are no destructive lesions; the reaction is good; and we have a proliferation of fibrous tissue which encapsulates the tubercular focus with connective tissue. This leads to the tumor like formations or as they are sometimes called tubercular papillomata of the larynx, or tuberculomata. These are the so-called benign forms of tuberculosis of the larynx. In contradistinction to this type we have the destructive kinds of tuberculosis that occur in the open lesions of the lungs where the tubercle-bacilli laden sputum infects the larynx directly, and the resistance of the body is low. This produces the exudative ulcerations with no tendency to heal, edema, and perichondritis. These two groups are not entirely separate and distinct, for they may coexist and

one form may develop into the other. But in general we classify our cases for the sake of diagnosis and prognosis according to Rickman⁽¹⁶⁾ into a productive and exudative type whichever predominates.

Diagnosis

The diagnosis of laryngeal tuberculosis is comparatively easy if we make thorough use of the laryngeal mirror. Every part of the larynx should be carefully inspected. Sir James Dundas-Grant⁽¹⁷⁾ called attention to the fact that the ventricles of Morgagni are more frequently affected in early stages than is thought. A forcible blast of air coming up the trachea enters the ventricles and forces the ventricular bands together. Hence secretion is caught in these cavities. Wotzilka and Adler⁽¹⁸⁾ demonstrated by x-ray films infiltration in the ventricles where the laryngoscopic examination was negative. But if we tilt the mirror slightly to one or the other side and observe while the patient is phonating "e" we will not fail to see even into the depth of the ventricles. While no part of the larynx is immune to tuberculous affection, the posterior part is more often involved. A well advanced case with characteristic mouse nibbled ulceration, superficial or undermined, with edema of the arytenoids, thickened aryepiglottic folds and enlarged epiglottis, occurring in a tuberculous patient cannot be mistaken for anything else. In the milder cases, however, some difficulty presents itself particularly in the differentiation from carcinoma and syphilis. But fixation of the cords occurs in tuberculosis of the larynx only occasionally from the cicatricial contraction of healed lesions. In every doubtful case, however, biopsy should immediately be done. Needless to say, the Wassermann reaction will establish the diagnosis of syphilis. So-called hypertrophic laryngitis and pachydermia laryngis offer some difficulty in differentiation from tuberculosis in the interarytenoid space. But Freystadt⁽¹⁹⁾ gives three points by which a diagnosis can be made; first, that the thickening of the posterior wall of the larynx is not symmetrical in tuberculosis. Second, in tuberculous infiltration the laryngeal picture does not change with the position of the vocal cords, and the movement of the arytenoid bodies. Third, in tuberculosis the thickening has a tendency either to increase in size or to ulcerate. To these Woods⁽²⁰⁾ adds the degree of swelling, the ap-

pearance of other parts of the larynx and the presence or absence of pulmonary lesion.

We cannot wait for subjective symptoms to diagnose laryngeal tuberculosis. Pain is not present in the majority of cases, and then it is a late symptom when the perichondrium becomes affected. Usually there is some fullness of the throat, uneasiness, irritation with cough, the voice is weak, tires more easily, and the pitch is lower. Suraci⁽²¹⁾ found 61.9 per cent of one series of cases of early laryngeal involvement without any symptoms, and 11.9 per cent of another series of cases of more advanced laryngeal tuberculosis without symptoms. To illustrate how the progress of this disease does not parallel its symptoms, I relate the following case:

D. Z., aged 45, carpenter, October 12, 1929. Complaint: Soreness of the throat for several weeks with hoarseness. Laryngeal examination revealed entire epiglottis swollen with ulcerations at the edge. Arytenoids edematous, almost presenting appearance of cervix uteri, pale in color with no redness anywhere. Ventricular bands smooth but thickened, much thicker on the left than on the right, overlapping the anterior half of the left cord preventing the cords from close approximation. Treatment was instituted at once. He was cauterized five times, also treated with trichloroacetic acid, and on November 30, 1930, one year later, he was discharged as a healed case with perfect speech. There was a large deficiency in his epiglottis: no ulceration and no swelling anywhere. He was told to come for monthly inspection, but failed to do so. I recalled him August 28, 1932, two years later to have a drawing made of his larynx to show a healed lesion, and to my astonishment I found an active laryngeal tuberculosis of the larynx with ulcerations and infiltration. The entire free epiglottis is gone. The stump is thick topped by ulcerations. Interarytenoid space irregular in outline and ulcerated. However, he is entirely free from pain and has gained weight, and therefore thought that he was well. X-ray of chest reveals, "Tuberculous fibroid and soft infiltrations both lungs with cavitation both uppers and thickened pleura of right base."

In making a prognosis, the first thing to be considered is the condition of the larynx. I know of no other disease, save some luetic lesions, which will clear up as rapidly as an early tuberculous lesion under the proper treatment. But the relation of the pulmonary condition to the larynx affection is an important one. For of what avail are the efforts of the laryngologist against reinfection and superinfection in a patient whose biological resistance is low and is declining rapidly? Yet we have seen cases in whom the lungs were

progressively getting worse while the larynx remained cured throughout life. To make this more emphatic I present the following case history, which brings out several important and interesting points:

E. B., aged 25, female, school teacher came to me June 30, 1919, with the complaint of hoarseness and cough. A papillomatous mass was found in the interarytenoid space, which proved to be tuberculous by biopsy. The mass was cauterized with complete healing. She was then sent to a sanatorium where no more attention was paid to the larynx. She reappeared again March 17, 1926, seven years later with complete dyspnea for which a tracheotomy was performed. The larynx presented irregular masses in the interarytenoid space incorporating the base of the left cord which was pulled over a great deal to the right side leaving very little opening for breathing. These infiltrations were all cleaned out with the cautery. The larynx remained healed ever since. Owing to the pulmonary condition which was constantly active we did not attempt to do more surgery to establish laryngeal breathing. Today it is six years since she wears the tracheotomy tube. She talks well, but with effort, by placing her finger over the tracheotomy tube or inserting the diaphragm, introduced by Iglauer. X-ray of her lungs show, thickened pleura with large cavity of the right lung, and tuberculous fibroid infiltration of the left upper lung.

This case demonstrates the tendency of the larynx to heal spontaneously, but the healing may occur with marked cicatricial contractions if untreated. It further demonstrated that a tuberculous patient can tolerate a tracheotomy tube very well in contradistinction to the opinion of Sir James Dundas-Grant⁽¹⁸⁾, who says that death follows shortly after a tracheotomy is performed. Finally it shows that the lungs can get progressively worse while the larynx remains well. While Safraneck⁽¹⁴⁾ has seen cases where the lungs remained stationary and even showed improvement and the larynx became progressively worse, the rule is as stated by Piery-Arbez⁽²³⁾, Looper⁽¹¹⁾, and others that the lungs will not improve if the larynx is progressively getting worse. Nothing is more pathetic than to have a patient succumb to laryngeal tuberculosis unable to eat or drink and constantly suffering from pain. Treatment instituted particularly in the early stages will not only obviate such final distress, but will cure the laryngeal condition in the great majority of cases.

Treatment

The general condition of the patient should be treated by the internist while the local affection is handled by the laryngologist. The

newer methods of treating pulmonary tuberculosis, such as artificial pneumothorax, phrenicotomy and thoracoplasty in suitable cases tend to arrest the progress of tuberculosis and hence raise the resistance of the body and with it the tendency to heal the larynx. This likewise is the object of all the so-called specific therapy such as tuberculin and other foreign proteins which have been discarded by most American workers in tuberculosis. The Germans still use crysalgen, a gold preparation, intravenously, and some use cooper salts in the same way, and claim to get good results in laryngeal tuberculosis. But here again the benefit is only indirectly through raising the activity of the body cells to fight the disease. The presence of any degree of laryngeal tuberculosis does not contraindicate any of these methods of general treatment.

There is only one specific for tuberculosis of the larynx, and that is the galvano cautery. What the cautery can do in one or two sittings no other method can accomplish. Fiel'ing O. Lewis⁽²³⁾ said of carcinoma of the larynx, that when it is possible to eradicate the malignant growth by surgical operation with a reasonable prospect of cure, no other treatment is worthy of consideration. We can say just as emphatically of tuberculosis of the larynx, that when a lesion can be eradicated by electrocautery no other treatment is worthy of consideration. Cauterization can easily be carried out either at the office or at the bedside of the patient. No extensive apparatus is necessary. There is no hardship upon the patient; it is not at all painful and is followed by very little reaction. There is no after-swelling and it produces negligible scars. I have seen patients in whom I have cauterized both cords several times almost thorough-out their entire lengths and in whom, months later, I could find no scars anywhere in the larynx, and the voice was restored. Ulcerations heal quickly and infiltrations disappear. In the tuberculomata we use the cautery to destroy the entire mass, while in the extensive exudative type we use it lightly to stimulate healing.

Trichloroacetic acid is a very valuable remedy in the ulcerated type in conjunction with cautery. The large superficial ulcerations will heal more rapidly if the cautery point is used in a few isolated spots and the acid applied to the entire area involved.

Next in importance is cleanliness. It is my belief that most of the pain is due to secondary infection, and the apparent beneficial results obtained from the usual topical applications, sprays and intralaryngeal injections of lactic acid, formaldehyde, iodine preparations, etc., are due to the cleansing effect on the larynx.

Vocal rest has not served us any purpose; first, writing is a laborious feat, and is depressing, and the patient is usually found to supplement his written conversation by a deep emphatic whisper which is much more exerting than ordinary speech; second, as Woods⁽²⁰⁾ says, the larynx cannot really be put to rest unless the recurrent laryngeal nerves are blocked according to the method of Schugt⁽²⁴⁾; for enforcing silence does not stop cough, which results in violent movements of the cords. Simins⁽²⁵⁾ advances the theory that when the larynx is at rest, the blood supply is lessened and hence ordinary speech which brings more blood to the part is actually beneficial.

Heliotherapy in the form of direct sunlight as well as the Kromayer quartz lamp has been tried by us when they were first introduced with absolutely no results. But lights have since then been improved and many authors claim to accomplish a great deal with the Wessley radiating machine. Bacmeister⁽²⁶⁾ sums up heliotherapy as a prolonged treatment at best, and the good results are obtained in cases that either remain stationary for some time or show some tendency towards improvement, which cases are well adapted for the cautery.

I will not speak of the other methods of treatment as there is a separate paper on this subject, but I wish to sound a warning regarding tonsillectomy in active tuberculosis. Woods suggests that tonsillectomy if absolutely necessary should be done by coagulation; but I would state that not even this method is safe in tuberculous laryngitis even though the larynx has been healed for some time. We recently had three cases where coagulation has invoked fresh tuberculous laryngitis which then became very resistant to treatment.

Laryngeal tuberculosis when complicated by invasion of the pharynx runs a rapid course and death results usually from a few weeks to a few months. Aubry⁽¹⁵⁾ states that local treatment is contraindicated in these cases.

We, however, found cleansing, and stimulating medications, good palliative treatment.

Pregnancy which is a very serious complication of laryngeal tuberculosis should not deter one from treating the larynx. Occasionally good results are obtained as is reported by Larregle⁽²⁷⁾. Recently we had such a favorable case with the following history:

R. S., aged 32, third pregnancy, October 21, 1929. Complaint: Three weeks before delivery she began to have pain in the throat, dysphagia, and hoarseness. She was delivered at full term with low forceps and had a severe post partum hemorrhage. Two weeks later she was admitted to a general hospital for medical treatment. X-ray of chest revealed fibroid infiltration of both apices and uppers. Blood picture showed marked secondary anemia with 50 per cent hemoglobin. Sputum positive for tubercle bacilli.

Larynx was found infiltrated throughout with extensive ulcerations. She was cauterized and treated with trichloroacetic acid and, owing to her extreme dysphagia, both superior laryngeal nerves were injected. She began to eat and improve greatly. Three weeks later she was sent to a sanatorium where she remained a little less than a year. She was discharged with the lungs completely quiescent and the larynx perfectly healed, with a very good voice. It is now two years since treatment was discontinued. She has been under constant observation and there has been no recurrence of the disease.

Conclusions

Laryngeal tuberculosis is curable. Treatment should be instituted early and kept up until cured. Then it should be watched like pulmonary tuberculosis for a long time. In my hands the cautery has proved to give the best results. Even in complicated and very destructive cases hope should not be abandoned. Surprising results may be achieved by treatment. Alcohol injection into the superior laryngeal nerves should only be practiced as a last resort after everything else has failed to relieve pain; and to tide over a marked dysphagia while treatment is going on. Small lesions of the larynx occurring in mild affections of the lungs may heal spontaneously, but we should not allow nature to doubtfully do the work that we can do with great assurance of good results.

1908 Eutaw Pl.

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COMPARATIVE VALUE OF THERAPEUTIC MEASURES IN LARYNGEAL TUBERCULOSIS

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Although it is my intention to restrict this paper to the therapy of laryngeal tuberculosis, it is important to draw attention to the site of the initial lesion. It has been my experience that the disease in the beginning most often affects, first, the posterior commissure; second, the vocal cords; third, the arytenoids; fourth, the ventricular bands and fifth, the epiglottis. There may be any combination of these and in massive lesions one finds them all. Most of our cases are chronic in nature. However, we do occasionally see an acute or even fulminating lesion. The lesions are either intrinsic or extrinsic. The intrinsic ones are those that are confined to the posterior commissure, the vocal cords and the ventricular bands and their prognosis is usually good. The extrinsic involve the arytenoids, the aryteno-epiglottic folds and the epiglottis and the outlook is bad. Again, the massive lesions combine both the intrinsic and extrinsic types and are very often fatal. Tuberculous lesions of the tongue, cheek, gums, soft palate, nose and tonsils are not common but they have occurred in my practice. Isolated small ulcers in the pharynx may heal but pharyngeal ulcers secondary to tuberculous laryngitis are usually hopeless. As for differential diagnosis one must rule out carcinoma, syphilis, chronic catarrh, benign papilloma, lupus and actinomycosis. It is interesting to note that a few patients with healed tuberculosis have later returned to us with carcinoma of the larynx.

In discussing the comparative value of methods of treatment one is naturally prejudiced in favor of the procedures that have given the best results in one's own experience. There are several main lines of attack.

First, I would like to emphasize that most important of all is the rest, dietary and hygienic regime as advised by the pulmonary specialist who should have charge of every case and with whom the laryngologist should be in complete accord. While local treatment is of utmost importance, the ultimate prognosis depends a great deal upon the pulmon-

ary condition, as tuberculous deposit in the larynx is always secondary to lung disease. Cooperation with the internist and roentgenologist, is, therefore, of decided value. Routine laryngeal examination should be made in every case. It is unwise to encourage watchful waiting on the part of the internist because patients may be neglected on account of lack of objective symptoms.

Galvanocauterization

Second, I wish to stress the fact that the most important measure in the local treatment of laryngeal tuberculosis is the galvanocautery. I have made increasing use of this form of treatment in the past few years and I am both encouraged and pleased. It was advocated by Greenwald in Germany, in 1907, and since that time has been used extensively in this country by Wood, Fetterolf, Levy, Spencer, Green, Looper, Brown and others. The method is curative in many cases and palliative in practically all. It produces an inflammatory reaction with the formation of new blood vessels in the avascular tubercle, also hyperemia, granulation tissue, and fibrosis. Blood and lymph vessels are sealed to prevent spread of the disease. Experimental work by Wood, in 1911, and by Fetterolf, in 1922, on localized tuberculous ulcers produced in the abdomens of guinea pigs, showed that tubercles healed after cautery by cicatrization. Wood thinks it takes three weeks to heal a tubercle by cautery. Sir St. Clair Thomson of the Midhurst Sanatorium, England, and Looper at the Maryland State Sanatorium, in an extensive experience with all stages of tuberculous laryngitis, report most favorable results with this procedure. Wood believes that 90 per cent of incipient cases can be cured by the use of the cautery. These men state that the value of this form of treatment in this disease cannot be overestimated. I believe this to be true. However, my percentage of apparent cures with the cautery is not so high because I seldom cauterize early

cases. I use this method of treatment only in moderately advanced and far advanced cases. My statistics are herewith presented. Despite opinion to the contrary,

TABLE I

667 CASES OF LARYNGEAL TUBERCULOSIS
SEEN IN PRIVATE PRACTICE

Incipient Tuberculous Laryngitis	= 30.68%	{ Improved = 98 % Unimproved = 2 %
Galvanocautery used in 1%		
Light used in 2.5%		
Moderately Advanced Tuberculous Laryngitis	= 28.77%	{ Improved = 91.66% Unimproved = 2 %
Galvanocautery used in 8.4%		
Light used in 4%		
Far Advanced Tuberculous Laryngitis	= 40.68%	{ Improved = 29.9% Unimproved = 70.07%
Galvanocautery used in 63.46%		
Light used in 7.38%		

I cauterize far advanced cases with high fever and emaciation, so that they can eat with less pain even if the eventual outlook is hopeless. It is my opinion that ignipuncture is needed in incipient cases rarely, in moderately advanced cases perhaps one-third, and in far advanced cases nearly always. My colleague, Dr. Beatty Brown of Saranac Lake, has come to the same conclusion through the years, and in a recent conversation we agreed that our results were about the same although he has not compiled his statistics.

Cautery never produces any alarming reactions in the larynx. In most cases the lesions respond well. Occasionally, however, the edematous ulcerative types will slough even to denudation of the cartilages of the epiglottis and arytenoids, and necrosis of the ventricular bands and vocal cords. In most cases we repeat ignipuncture every two, three or four weeks depending upon the progress and reaction until the patient is well on the road to recovery. As regards technic I use the indirect method always — thorough cocaineization, then from four to eight punctures at the site of the lesion an eighth to a quarter of an inch apart. I have often made as many as fifteen punctures. White heat at the platinum point of the electrode prevents sticking and possible hemorrhage. Electrocautery is an adaptable procedure which can be performed at the bedside of the patient. This is important as most patients who require this treatment are too ill to go to the doctor's office, the attendant exertion being harmful to the general condition.

In some cases I have seen the laryngeal lesion healed by the use of the cautery while the pulmonary lesion was advancing. On the

other hand I have never seen a pulmonary lesion heal when the laryngeal lesion was progressing unfavorably.

Third, vocal rest meaning the whispered voice or complete silence with the patient using pencil and pad should be enforced. Regardless of what one uses as the primary factor in treatment I do believe that vocal rest should be advised as an adjuvant in every case. Less talking spares the lungs as well as the diseased larynx. However, it is not easy to get patients to observe this rule.

Ultraviolet Treatment

Fourth, it would seem that sunlight, both natural and artificial, has received the endorsement of most men of experience in this work. Strandberg, Director of Otolaryngeal-ogy at the Finsen Institute, in a recent report (1928) advocates general sunlight radiation, natural or artificial, to the exclusion of local light radiation with the hope of increasing the immunobiologic reaction of the body. He prefers natural sunlight because it has a continuous spectrum, but finds it to be available in very few parts of the country so as to be depended upon each day. At the Finsen Institute they use the carbon-arc lamp for universal light baths because it most nearly approaches sunlight in having a continuous spectrum. He has treated 203 patients with laryngeal tuberculosis this way, all, of course, having pulmonary tuberculosis. Of the 113 who were cured, 77 were intrinsic, 34 mixed, and 3 extrinsic, showing that the intrinsic lesions are more favorable. Strandberg says that he does not use the mercury vapor lamp because it has a line spectrum which differs from a continuous one in that it contains luminous lines broken by dark intervals. He does use electrocautery where indicated in conjunction with heliotherapy.

At the National Vaudeville Artists' Sanatorium in Saranac Lake we have a solarium for natural sunlight enclosed with quartz glass and heated for winter, the sides and roof of which can be opened for summer. There is also a carbon arc universal light bath room and a mercury vapor lamp section for general radiation. Ten patients or more can be treated simultaneously in each department. All the cases under treatment have pulmonary tuberculosis with a few having laryngeal involvement. It will be interesting to see if any cases develop laryngeal tuberculosis while

undergoing heliotherapy and, also, if those who have this complication will later need local treatment such as cautery. Our statistics of these sanatorium cases are not available as yet.

I have used light very little in private practice except as an adjuvant. Natural sunlight cannot be relied upon in our locality, and the few cases who have tried out the Verba laryngoscope by reflecting natural sunlight into the throat with mirrors have become discouraged and have discontinued, because there are not enough consecutive sunny days. Forster, in Colorado Springs, and Sorgo, abroad, have reported good results with this method.

I have used the Kromayer water cooled mercury vapor lamp locally in a few early and moderately advanced cases, but these same types get well under conservative treatment such as vocal rest and observation. I therefore feel that one is not justified in advising such patients to come for frequent treatments because of economic reasons. More advanced cases who need this attention are also deterred for the same reason especially as I have been able to secure so much more rapid results with the cautery. Occasionally, however, I follow successful cautery cases with artificial light locally, to tone the tissues, but I really do not know if it helps.

Wessely has reported excellent results in the Hajek Clinic in Vienna by the use locally of the Goerz-Wessely lamp which is a carbon-arc water cooled quartz lamp the arc light of which contains a specially impregnated carbon. Strandberg is of the opinion that the metallic salt in the carbon changes the continuous carbon-arc spectrum to a line spectrum thereby lessening beneficial effects. With this lamp patients can be treated directly with the Killian suspension or the Seiffert auto-scope, or indirectly by reflection from an all metal laryngeal mirror which reflects 44 per cent of the therapeutic rays whereas glass absorbs most of these rays. Dr. Miller of this city is enthusiastic over his results with this method and I believe will tell you something about them in the discussion. This lamp is not portable and very ill patients are at a disadvantage to come to the office.

General body radiation with natural sunlight in the treatment of laryngeal and pulmonary tuberculosis has been practiced in southwestern United States but no very definite statistics with controls are available. In

local applications it is questionable if enough light enters the larynx to be of much value. Direct laryngoscopy for treatment by cautery or by heliotherapy is too formidable and too severe a procedure for repeated use in tuberculous patients especially if the larynx is sore.

Fifth, various topical applications of medicines have been used throughout the ages and I am still old-fashioned enough to have some faith in these as palliative measures, to be sure not believing that they are curative. They cleanse the larynx of sputum and give much relief from irritation even to the point of diminishing cough which is always disturbing. The number of drugs that have been used is legion. I have found only a few to be of value. These are guaiacol in oil and metaphen in oil for tissue stimulation; and butyn and cocaine for the relief of pain. I have used lactic acid, formaldehyde, silver solutions, gomenol and the dyes without result. The analgesic power of orthoform, anesthesin and euphagin is too transient for pain. Chaulmoogra oil has been used extensively and Lukens has been impressed with his results. I have spent some time in his clinic at the Phipps Institute and I know that his patients have done well. Nevertheless, my own experience with this drug was not encouraging and I have discontinued its use. We have resorted to narcotics by hypodermic only in terminal cases. Tuberculin as treatment is seldom used nowadays.

Sixth, surgical procedures such as curettage of ulcers or amputation of the epiglottis are rarely practiced now.

Alcohol injection of the superior laryngeal nerve is successful in relieving severe pain in a fair percentage of attempts but it is rare that one needs such a measure even in advanced cases now that electrocautery is available as this latter procedure alleviates much of the pain. Moreover, pain due to ulceration of the epiglottis is not affected by alcohol injection of the superior laryngeal nerve because the glosso pharyngeal nerve supplies this region. Shugt has successfully injected the superior laryngeal nerve by way of the pyriform sinus in a few cases. Section of the superior laryngeal nerve has been performed but has not come into general use.

Induction of artificial pneumothorax acts favorably on the laryngeal lesion in many cases and in Dworetzky's series without laryn-

geal involvement I believe no new cases developed after pneumothorax was started. Cooper and Benson's recent report from Fitzsimons General Hospital confirms this. I have observed this phenomenon many times. Phrenicectomy and thoracoplasty should give similar results.

I have had no experience with the use of x-ray, radium or diathermy in laryngeal tuberculosis. These measures have been tried but have not stood the test of time.

Conclusion

In summarizing I would say: first, that the hygienic treatment as advised for pulmonary tuberculosis applies to laryngeal tuberculosis as well. In favorable cases both the primary and secondary lesions heal on a regime of rest, diet, fresh air, climate and so forth. Cooperation with the pulmonary specialist is, therefore, of paramount importance.

Second, that galvanocautery is the most valuable measure in the local treatment of laryngeal tuberculosis.

Third, that vocal rest exerts some influence for good and that the use of topical applications should not be entirely discarded.

Fourth, that heliotherapy is valuable (locally and universally) as an adjuvant. I, personally, do not feel inclined to depend entirely upon it as I would not care to give up the use of the cautery in advanced cases.*

Discussion

Dr. George B. McAuliffe (New York): The phase presented today gives one too much the idea of tubercular laryngitis being a primary condition. I think we all know that primary tubercular laryngitis is very rare. The condition of the larynx is predicated upon the condition of the lung. It flares up because of the increased irritation to which it is subjected.

We have about 23 per cent of tubercular laryngitis in tuberculosis cases, less than that in women. There must be something, smoking or irritation, in the men's larynx which renders it more susceptible to tubercular infection. I think it is a phenomenon of the pulmonary type. The cure also goes along with the pulmonary condition.

Naturally, when you have a condition such as you have seen here it will succumb to treatment if the pulmonary condition is quiet. If it becomes exudative I do not think that a local treatment of the pharynx will forestall the ultimate result.

There is no doubt that a great deal can be

done for the local lesions. We, as laryngologists, get these cases in their inception. I would not, myself, pretend to treat these advanced cases because I believe they should all be sanatorium cases. I do not believe anyone in the city should treat tubercular laryngitis which is advanced. He should be in a sanatorium. Besides, all of the methods of treatment adapted to tubercular laryngitis imply rest and patients cannot get that at home. They must have bodily rest and vocal rest. On that score we have tracheotomies to give local rest, and gastrostomy to give freedom from pain in swallowing. All those measures imply rest to the larynx. Every one of the treatments imply, also, that the sanatorium is the only proper place for those cases.

I am surprised that one of the speakers advised talking. I think that vocal rest has proven itself quite efficient in allaying irritation. If one has a sore eye one tells you to avoid reading, or irritation. The same thing is true in all conditions.

There is one thing that laryngologists and rhinologists ought to look out for when patients come with a suspected tubercular condition; they ought to be careful about operating. I remember a man who had no particular laryngeal or pulmonary symptoms. He came to me and I did a nasal operation. After he recovered from the operation I heard no more from him, monetarily or otherwise, until I got a note from him accusing me of having given him pulmonary tuberculosis. In other words, the operation had weakened him so that the latent tuberculosis flared up. Therefore, it is well not to rush into operations.

We laryngologists have the reputation of operating as soon as we see an infected tonsil without any regard to the patient's resistance or general condition. Furthermore, the diagnosis of tubercular laryngitis is not always made absolutely by the laryngologist. He must have the protective influence of pathologists and bacteriologists and the x-ray man and so forth, to confirm his presumed diagnosis. We may see a little thickening of the posterior wall, a peculiar pallor which is present in tubercular cases, and we can only make a presumptive diagnosis. We need all the aid the internists can give us to be sure that a given case is one of tubercular laryngitis. The best thing is to put the man into a sanatorium without trying to treat him.

Dr. M. L. Harris (Brooklyn, N. Y.): About seven years ago Dr. Joseph Miller came back from Vienna. He brought with him the Wessely lamp which Dr. Wilson mentioned. Since that time we have treated about 150 ambulatory cases. Each had a pulmonary lesion. There wasn't a single case that we could call a primary tuberculosis of the larynx.

Most of them were treated by ultraviolet radiation as provided by the sun lamp of Wessely. They came to our clinic complaining, the vast majority of them, of pain. We used that lamp but occasionally in most of our cases, and only where the hyperplasias are marked. For tubercular masses we used a cautery. We have bitten

* I desire to express my sincere appreciation to Dr. I. R. Tabershaw, resident physician at the N. V. A. Sanatorium, for compiling the statistics and to Mr. Charles Libecap, artist and photographer, for preparing the lantern slides.

off the mass with a punch, and then cauterized instead of destroying it entirely. We have brought about some improvement.

Primarily it is the ultraviolet that we use. A metal reflecting mirror is used, put in the mouth by some form of stirrup, the patient sits and holds the mirror while the light is shining on it. The lamp is a carbon arc lamp. It produces a radiation of from 280 to 310 millimicrons and in this way we presume that it simulates the sun. It is preferable to the mercury vapor lamp.

As I mentioned, the patients come for relief from pain. I have seen patients with ulcerations of the larynx and after three, four or five treatments they would be entirely relieved of pain. They were enabled to eat and nourish themselves, and so it helped them to fight the pulmonary disease. Those that were not helped suffered from marked infiltrations and edema.

There is one thing that nobody has mentioned in the paper. As I said, all of these cases are ambulatory. We have done red blood sedimentation tests to see the resistance of the patient. We find that where the sedimentations are rapid the patients do not react but succumb. That is in the pulmonary condition. If the patient has a rapid sedimentation we know the prognosis is grave.

Dr. George B. Wood (Philadelphia): I tried to develop in the treatment of laryngeal tuberculosis some 20 to 25 years ago, the idea which is beginning to be universally adopted. I do not mean to say that I first conceived the idea of using the electric cautery, but at the time I started in the Phipps Institute I knew nobody in this country who was extensively using it in laryngeal tuberculosis.

Two cases brought to my attention the great value of the electric cautery and led to some experimentation. There was a nurse at the Phipps Institute who had a pharyngeal ulcer the size of a quarter of a dollar. She had had it for several months, and she had a pulmonary lesion without any laryngeal involvement. This was cauterized and in two weeks there wasn't a sign of it. I had another patient who developed pain in her tonsils. She had pulmonary and laryngeal tuberculosis. Her cord, which had completely infiltrated, had cleared up so that years later you could not tell it from a normal one. The interesting fact was that she developed pain in her tonsil and I removed a portion of her tonsil with a cautery snare and found it filled with milary tubercles.

There is one point concerning the tonsil, namely, that it is practically involved in every case of pulmonary tuberculosis that goes to autopsy. I made autopsies on some 36 cases and studied the tonsils of those that had died from pulmonary tuberculosis. We found evidence of tuberculosis in every one of those patients, and there were lesions in the tonsils demonstrable with the microscope. In the case I speak of, the woman was relieved of her pain, but I took out another piece of tonsil and instead of biliary tubercles, I found milary scars all through the tonsil.

We then started some experimentation. We

developed tubercles, as has been mentioned by Dr. Wilson, on the abdominal wall of a guinea pig, on both sides; on the right side we drew a cautery knife through them, on the left side we cut them almost all out. Within two weeks the ones on the right side had absolutely and invariably disappeared, while the left side progressed. We studied these at different intervals to see what happened. I would like to draw a diagram because it is the keynote of the treatment of laryngeal tuberculosis with a cautery.

(Illustrating.) You have here an elevated area with the skin still intact. Beneath that you have a tubercle, which is vascular. There are no blood vessels in that tubercle. You make a cautery wound in that tubercle. In three days we have surrounding that polymorphonuclear cells and round cells in large quantities, blood vessels running through this tubercle to form an area of granulation tissue around it. In other words, we do not destroy that tubercle, but revascularize it. We bring blood to tissue that has no nutrition. Consequently, in our treatment of laryngeal tuberculosis we do not attempt to destroy, we attempt to stimulate the formation of new blood vessels. That is precisely what happened in those guinea pigs.

Believing in the use of the actual cautery in laryngeal tuberculosis, seeing the results that I have obtained, and hearing the results that others have obtained, I have not had the opportunity of trying out other methods of treatment. I am impressed with the results that have been obtained by Dr. Miller, by Dr. Wessely and others who have used electricity. I have read the favorable reports of those who have used x-ray in small doses, and have heard favorable reports on the use of the x-ray in laryngeal tuberculosis. I know what Dr. Lukens believes, and I haven't obtained any results with his method because I haven't had a chance to use it. The condition will heal up if we use the cautery.

There is one other point, and I think a most important one, that the biologic resistance of the individuals is sufficient to produce a healing process. If they have enough resistance to reduce granulation and allow the tissue to heal a traumatic ulcer, their chances of cure are good, provided the lesion is still intrinsic in the larynx, and that there is no skeletal involvement of the larynx. If that lesion has passed beyond the confines of the larynx down into the piriform sinus or into the musculature of the pharyngeal wall they will never get well. Epiglottic lesions, to my mind, invariably get well if properly treated unless they spread, as I saw one case spread from the use of punch, and form down into the area of the glottis.

I was very much impressed by the work that Manassa did in Germany on the pathology of laryngeal tuberculosis. We have never had anything like it. He has written a perfect monograph on it. There are one or two things that he has brought out that are very important.

First, there is the formation of the ulcer. A tuberculous ulcer is not necessarily evidence of caseation. If the tubercle is close to the cells

of the epithelium, it involves the basal cells of the epithelium by an infiltrative process without caseation. Another thing that he has shown is that the spread of a local lesion in the larynx is by way of the lymph vessel, that is, you get a thrombolympangitis and in these cases you find pathologic evidence of tuberculosis in the vessels. That is important because it shows the dangers of traumatic surgery, the dangers of using punch forceps, the dangers of using a cold wire snare for the removal of the epiglottis. Some of the bad results I know in the amputation of the epiglottis followed the squeezing of that part and forcing the tubercle bacilli into the surrounding lymph vessels.

I am very much interested in what Dr. Kemler said about the voice. I still insist that my patients should keep quiet. Theoretically, what we want is more congestion in the larynx and if the use of the voice produces congestion why it ought to help us. We ought to do it. But, still, I haven't the nerve to use it. And I shall still keep on telling my patients, "You better use a pad and a pencil if the lesion is moved by phonation." I mean by that if it is in the arachnoid or in the posterior commissure.

Dr. Newburgh (U. S. Navy): I would like to ask both of the gentlemen who read their papers what type of anesthesia they use, and the method, and how long it takes before they can actually start using the cautery.

Dr. McMahon (Loomis Sanatorium): I am not a laryngologist, but Loomis Sanatorium, where I work, does not have a laryngologist and we felt the need of cautery. I was sent away to learn something about it. For several years I have been using it. Perhaps our results are not as good as those reported here, but we feel it is valuable.

I wish to touch on the pathology. Since the acceptance of the work of Ranke in the pathology of the lungs, in the pathology of pulmonary tuberculosis primarily, secondary and so forth, and the exudative types, the attempt has been made to correlate productive and exudative types in the region of the larynx, but they were not able to do it. It didn't work out that way, particularly from the histological point of view. There was a histologic difference between the productive and the exudating ones. Like Dr. Wood, we have been following the work and have found it extremely helpful.

The generally accepted theory of sputum in the origin of laryngeal involvement holds true. In the pathology of the lungs we have changed our conceptions. In the work of Sherman and Redeker in Germany, appearing largely in the German literature, it is shown that instead of using the Ranke classification, which was found inadequate for many things, you find on x-ray and autopsy that they are classifying them as pulmonary tuberculosis, and are putting them largely into two types, the infiltrates and the hematogenous tubercles in the lung.

Along with that I have been interested in the larynx. It seems to me that I found it hard

to reconcile the tubercles in the larynx where you found massive infiltration with edema involving the larynx as a whole, usually distributed and frequently without breaking down. You can get that from the sputum and almost invariably you find that picture.

Being a phthysiologist, when I see the larynx I try to visualize what the lungs are like, and when I see massive infiltration with edema I usually find, in the upper two-thirds of both lungs, an exudative tuberculous involvement. If that is so, and since we know that the tuberculosis bacillus is frequently in circulation in the blood stream without giving rise to disease, it is easy to see how it can be deposited in the larynx. With that particular case I think it might arise from the lungs.

I am particularly interested in the whisper technic. We find that a patient who has been on a whisper regime for a long time has his larynx entirely healed, but after that they cannot talk but still continue to whisper. That is one reason that we object to it. The other thing is that when you tell patients to whisper they talk with a greater strain on the larynx than if they spoke normally. If we can get them to whisper with the lips then all of the sound is made with the lips and the larynx is rested. If they do that they do well on the treatment, but we prefer to have them speak normally, and not much, and as infrequently as possible unless they are lip whispering.

The comment was made that the progress of the disease in the larynx and the lungs was not the same. We haven't found that to be so. The larynx may get well, while the lungs get worse. If the larynx is getting worse the lungs, invariably, are getting worse, too.

There is the incidence of cautery. I am glad to hear Dr. Wilson say that he uses it in advance cases. Our practice in Loomis shows that if there is an ear involvement, or there is an involvement of the laryngeal nerve there doesn't seem to be any relief. In cauterization we get greater and more prolonged relief. It is our practice if the larynx presents the predominating symptom to use cauterization, not with the hope of curing them but for the relief they get. Two of our cases, which had all the aspects of becoming terminal got well, and all lung men agree that cauterization of the larynx helped.

Dr. Lewis J. Silvers (New York): Why don't we coagulate in the larynx? Why is it that we have turned aside the burning of tonsils which had been practiced 20 or 25 years ago and was passed off in disrepute? Why is it that we now coagulate tonsils and we dare not coagulate in the larynx unless we are very careful with the technic and with the type of machine and current that we use?

Dr. Wyeth has shown conclusively that by using a needle of definite caliber through a piece of meat the action of the cautery is local. Very little sloughing ensues after the action of a thousand milliamperes of current passes through a needle of given caliber in a given time. We take

the same needle, apply it to the same piece of raw beef and we find that it completely and homogeneously coagulates the entire area. We have here a mass with an ensuing slough that is sometimes considerable. If we are to destroy the tubercle and insure vascularization, as Dr. Wood has shown us here, we certainly cannot attempt it by destruction with coagulation.

Another point is the mooted question as to the removal of tonsils by any method in tuberculosis. We know definitely that surgery is contraindicated in active tuberculosis. I have tried to prove that I could get the tonsils out in cases where it seemed absolutely necessary to remove tubercles within the tonsil by means of electrocoagulation. I have had success in those cases that did not show what Dr. Wilson so clearly pointed out, the grayish, greenish slough that appears directly upon application of the electrosurgical applicator.

If there is no sloughing reaction, if there is a healthy tissue following the application of the electrocoagulating applicator, we can go ahead and remove the tonsil regardless of the condition present. But, we cannot attempt to do it in less than six, eight or ten applications to a tonsil. It has to be done very, very slowly and very carefully.

Dr. George B. Wood (Philadelphia): I want to endorse what has been said about the attack on the tonsil by classic surgery in tuberculosis. I tried to preach that and people would come to me and say, "These tonsils have to come out." I have never yet seen any bad results from the use of electrosurgery or cautery on the tonsils.

Dr. Joseph I. Kemler (closing): I did not state the general treatment; though it is in the paper. I thought it might be too long to read so I purposely omitted it. But, the most important point is in the general treatment. Our cases are all hospitalized or put into a sanatorium until they are rested or are ready to be discharged. Of course, we do take care of them afterwards in our Mount Pleasant Sanatorium of Baltimore City, where we have a field worker. When they are discharged the field worker is after them for years and years until the doctor tells them that they are absolutely clear. At the same time, even though they are perfectly cured they have to be inspected, may be once in three months, or once in six months, but they are constantly under observation.

As far as silence is concerned, I am very glad that Dr. Woods made the same observations I did. We haven't entirely abandoned the silence, but we do not use it as much as we did before. I have never seen any benefit from it. In incipient cases where I thought that here was a slight inflammation of the cord and that I would put the patient on complete silence with rigid enforcement, we waited a month or six weeks and we would get no results at all. I cauterized, or touched up the infiltrations and inside of ten days to two weeks they were completely healed. You could not see where the cautery had touched it.

That is the reason that silence cannot be recommended as an entity of treatment.

As far as anesthesia is concerned, I have used, for the last 20 years, 20 per cent cocaine in the larynx by the drop method. We use it and we do not have to use much. The quantity is absolutely according to the patient. I have cauterized with 5 drops many times. That meant only 5 drops in the larynx, and again I have used much more than that. But you must remember that while pain would be relieved with a very few drops of cocaine the reflex is not abolished. You have to anesthetize further to get good results, in order to get the cautery to the point where you want it. That requires greater anesthesia than mere painlessness. Pain will go very quickly with one or two drops.

Dr. George E. Wilson (closing): There must be a great deal of doubt in the minds of the workers as to the value of silence. I am glad that Dr. McMahon demonstrated the difference between whispering with the larynx and whispering with the lips. That is what we are trying to do. I firmly believe that silence used in that way is of value because among that rather large number of incipient cases that I see I rarely used the cautery. Many with infiltrations of the throat or of the vocal cord cleared up with nothing more than local rest, silence, whisper with the lips and topical palliative measures. I firmly believe silence is of value.

Dr. Kemler mentioned thickening of the ventricular bands which cannot be seen with the laryngeal mirror below the ventricle. In the last two years we have been doing some work along the lines of taking x-rays of the larynx. It was not original with us. Considerable work has been done in Germany, and a radiologist in the city is doing it.

We find, of course, that in the moderately advanced and advanced cases there are definite changes in the larynx, the contour and thickness and even in incipient cases they can sometimes pick out something. I cannot see where x-ray of the larynx is going to help the laryngologist very much. He can see so much more with the laryngeal mirror. He doesn't need the x-ray. As far as seeing the mild infiltration in the ventricle is concerned, if you cannot see it with the laryngeal mirror but suspect it, order silence. If you do not, I do not think that is of much importance. If you cannot see a lesion in the larynx, if your patient has an occasional laryngeal examination, say every one or two months, I think you are safe.

There is the question of tonsillectomy in tuberculosis. Dr. Wood warned me against that many years ago and I have been very conservative. I am in a resort where I have to do tonsillectomies on tuberculous patients. If I can get the pulmonary specialist to agree that it would be all right to do that, I do it under local anesthesia. In three cases I did it under ether. I hesitated about that, but it seemed necessary to do it to arrest the cases and they got along all right.

There seems to be a question on how much irritation takes place in the bronchial tubes. I wouldn't want to venture, but we do this under local anesthesia, and if the pulmonary condition is active we do not do it except by electrosurgery. I introduced that during the past year and have treated about 12 or 15 tuberculous patients in that way. They were all in pretty good condition, too. The lung specialist thought it would be best to do it with electrosurgery and they are getting along all right.

Dr. Harris mentioned the sedimentation test. That is being done everywhere in tuberculous resorts now and is found of great value in prognosis. The high sedimentation rate certainly follows along with the clinical picture. At our weekly clinical meetings at the sanatorium, where we discuss our new cases, we have sedimentation tests along with other laboratory work done, and it follows the clinical picture closely. In the laryngeal cases that come to me in private practice I have not followed that. Many of the sedimentations are done by the men who prefer them. It is impossible to do that at all times but it is valuable.

Dr. McAuliffe mentioned the question of the primary tuberculosis of the larynx. Dr. Kemler says he gave a rather convincing evidence of a case that he saw which showed nothing in the lung. Of course, I have had it impressed that primary tuberculosis of the larynx does not occur. But, I can believe it would be possible to see a case in which the x-ray would not show a definite lesion. As Dr. Kemler says, if we could autopsy that man we might find something in the microscope slide.

I believe with Dr. McAuliffe, that the sanatorium or the rest cottage is the place for these patients. Also, on the question of operating, it is hazardous to operate on tuberculosis patients especially for doctors who are away from the health

resort because if the patient develops tuberculosis the doctor is going to be blamed for it. That has been voiced around and they are always looking for a chance to blame somebody else for causing them to break down with pulmonary tuberculosis. I cannot conceive anyone having a tonsillectomy done and six months later developing pulmonary tuberculosis on account of that. But, you cannot make the patient believe that. Therefore one should be careful. I feel that I am in a safe spot in doing tonsillectomy on the patients, because the indication is confirmed by our chest specialist before the patient is turned over to me.

I mentioned curettage and amputation in the epiglottis being seldom done. Dr. Wood told me that the question of curettage was wrong and he felt that it was safe if you followed with cautery, but that he also believed that cautery alone would accomplish anything that curettage plus cautery would do. That is so. I seldom use the curette. I have amputated the epiglottis in two or three patients where I did not want to use it. I have waited for the cautery. I cauterized around the area I amputated.

You will find that many men state that the prognosis in epiglottidean tuberculosis is worse than any other type. I think Spencer in his recent book, which came out four years ago, mentions that. It hasn't been so in my experience. I do fear that, but I have seen so many cases controlled under cautery that I do not look upon them as being hopeless.

I was very much interested in what Dr. McMahon had to say about the pathologic changes. I believe it is a much mooted question as regards sputum or the primary infection being from the irritation of the cough and the larynx being bathed in sputum or the question of dissemination through the lymph and blood vessels.

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ULTRAVIOLET TREATMENT OF ORAL ABSCESES AND PERIAPICAL INFECTIONS

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The use of ultraviolet for therapeutic purposes in dentistry was not investigated by the dental profession until about 1920. Work was begun with a complete lack of any information that could serve as reference. There was nothing to which one could turn for guidance. What data had been compiled in medicine at that time, were not applicable to dental needs. Naturally, a complete and comprehensive study had to be begun along lines of physiological reactions and effects, bacteriological results, and channels that in the end would establish absolute results.

It required little time to realize that the entire subject of ultraviolet radiation, its actions and reactions, would have to be viewed empirically. Until the physiological actions could be definitely proven in the laboratories, the results achieved could be arrived at solely by noting and checking such details as became apparent.

Such knowledge is easily disputable, but being upheld by definite and unfailing results, one first accepts the conclusions reached and delves into the intricacies of the biochemical reactions afterwards. Such was the case when this new therapeutic agent was put before the profession in a few articles in some of the foremost dental periodicals, and, needless to say, a great wave of inquiry was started.

This interest was followed by a wave of skepticism and criticism. How could such reactions be possible? How could such results be accomplished? If ultraviolet rays could not penetrate, how could teeth with chronic abscesses be treated and cured of pus sacs surrounding their apices? How could pain be diminished and how could infection be checked?

The patient, for years past, had become educated to the idea that all abscessed and pyorrhetic teeth had to be extracted, because they were a menace to health. Before this new form of treatment had gained headway the physician had been practically convinced by

previous experiments, that abscessed and pyorrhetic teeth were foci of infection, resulting in any of a great number of serious ailments, so that they were sure that such teeth could never be cured by light or any other means. Dentists in all those years past had been told to extract such infected teeth because they could not be cured otherwise, and so it became the established practice.

There were some who saw the possibilities of ultraviolet treatment and began to experiment along their own chosen field, with the result that very soon they began noting favorable findings, and published the facts in dental journals.

It naturally followed that some of the less experienced came forth with rash statements, due to over-enthusiasm. This brought forth acrimonious controversies, and the merits of this therapy were disputed and even denied. So keen did these controversies wax, that there followed a lull in the field of research which lasted a few years.

But this subject was too important to lie dormant for any length of time. The work that had already been accomplished and the results that had been attained, would not allow this subject to be entirely forgotten. Those who had originally brought this form of therapy before the profession, again published the results of their studies, but this time with definite statements and proof. The result of this was generally acknowledged and ultraviolet radiation was finally accepted by the rank and file.

What was just a fad or an imaginative fancy twelve years or so ago, has finally become a scientific fact.

It has been definitely accepted by the foremost and leading dental organizations. The colleges of dentistry in our country, as well as in the countries other than ours, have begun to teach this subject. Several of the leading institutions have gone so far as to establish postgraduate courses.

In the field of dentistry, ultraviolet rays can

be applied with beneficial results in the following conditions:

1. Abscessed teeth, acute and chronic, with or without fistulous tracts, with or without edema.
2. Vincent's angina, with or without complications, such as scurvy, etc.
3. Stomatitis, in various forms, common to the oral cavity.
4. Tubercular lesions of the mouth, with or without complications.
5. Pyorrhea alveolaris, in the first, second or third stages.
6. Blind cysts, intraoral or extraoral.
7. Postoperative infections, with or without complications, such as osteomyelitis, glandular involvements, etc.
8. Prevention of infection in all postoperative surgical cases.

Technic of Treatment

The manner of treatment in the above conditions has been so often and so thoroughly explained, that there is no further need for details, yet certain essential points should be considered. Many have failed because they have not heeded these certain factors while much of the success of the treatment can be traced directly to their observance. We will consider each of the above conditions individually.

In treating abscessed teeth, it must be remembered that in conjunction with ultraviolet radiation, the area containing the pus, must be drained either through the apical foramen or through an artificial opening in the mucous membrane in the region of the apical end of the tooth. The pus must be evacuated. Root canal therapy must be thorough. The canal or canals of the tooth must be sterilized and filled to the apices. Half-way measures will not suffice and improperly condensed root-canal fillings will in time reproduce the same condition. X-ray photographs should not only be taken both before and after the entire course of treatment, but also in about six months after the treatment has been concluded. This is a more conclusive test than any other means at our disposal.

In the treatment of Vincent's angina, it is essential to refrain from scaling of teeth when the patient first reports for treatment. Too early scaling will not only be most painful and bloody, but will merely aggravate the

condition and tend to spread it. The laws of sanitation are strictly to be observed, even to the boiling of the applicators. Extractions or the opening of any parts of the mucous membrane *must be avoided*. Only after three or four light radiations have been administered and the patient reports a marked relief, which can easily be observed from the appearance of the tissues, should scaling be begun. Extractions of teeth must not be attempted until the disease is entirely eliminated. Bacteriological smears must be taken and the results ascertained before the patient can be declared cured.

In the treatment of stomatitis the very same conditions hold true.

In treating tubercular lesions of the mouth, it is wise to take into consideration the general physical condition of the patient, and to cooperate with the physician in charge, in the matter of diet, general constitutional condition and other manifestations.

Pyorrhea Alveolaris

In pyorrhea alveolaris with a heavy deposition of salivary or ceruminous calculus, it is essential to first remove these as all other impediments to a normal healing. In conditions presenting a painful, bleeding, swollen and pussy mucous membrane, removal should not be attempted before several treatments with ultraviolet light have been given and a decided improvement is noted.

When the condition has plainly affected the occlusal plane, and the bite has been disturbed, it is necessary to bring about relief by artificial means, in conjunction with our treatment. In the presence of a general constitutional disorder, such as tuberculosis, syphilis, diabetes, etc., cooperation with the physician is essential. Where the periodontal membrane and the alveolar process have been so destroyed as to barely be visible above the tip of the root end of the tooth, treatment has proved valueless.

In blind cystic formation, the rays should be applied directly to the area and not shifted, but held firmly in one area. When opened, the cyst should be thoroughly drained, and kept open, until all the pus is evacuated. Drainage tubes are ideal for this purpose. These should be changed frequently. The treatment with the light should be given with the applicators directly inserted through the sinus, and the drains should be inserted only after such radiation.

Prophylactic Radiation

In postoperative infections and for preventive measures, the applicators should be inserted directly into the area, but pressure should not be applied. Here, too, drains may be applied where called for, but they should be removed when the treatment is to be given and changed. Home treatment is not essential, and is left to the discretion of the operator.

The advantages of ultraviolet therapy are apparent, numerous, and conclusive. It is almost impossible to enumerate all of them.

Simplicity of the treatment is one of its most important claims, absence of all possibility of shock to the patient is another. Avoidance of all noise, pain, or other sensation during treatment, is a boon, especially to patients of nervous temperament. The avoidance of the possibility of hemorrhage and safety to the hemophilic means ease of mind both to patient and operator.

In practically every form of surgical intervention and in many of the other types of treatment, scars are left after healing has occurred. This has caused more discouragement than anything else, but with this form of treatment there are no scars to point to any previous infection.

The time required for treatment with this form of therapy is often a fraction of that required with others. The fact that the probability of reinfection is reduced practically to the minimum, speaks much for this treatment. The action of the light on nerve endings, diminishes the pain during treatment practically eliminating necessity for home treatment. The percentage of cures, as compared with other forms of treatment, is far greater, as proven by the follow-up tests such as x-rays, bacteriologic, microscopic, and macroscopic examinations.

Report of Cases

Some recent cases that have been benefited by this form of treatment and that stand out from the average are:

Case 1. Mr. F., restaurateur, aged 30 years. Several days ago he had eaten an apple and shortly after had become aware of a sticking pain in the gums in the region of the lower incisors. Slight bleeding was noticed, insufficient to cause alarm. Examination by him showed nothing. For two or three days this sticking pain persisted, and the gums in that region became slightly swollen and inflamed. On the next day, upon awakening, the entire lower anterior

part of the mandible had swelled until the patient could barely open or move the mouth and the chin muscles were barely able to function. Speech was badly impeded and the patient was extremely alarmed.

The patient appeared at the office in an extremely nervous condition, scarcely able to talk, or give any account of what had occurred, beyond the fact that after eating an apple, he had become afflicted.

Examination of the interior of the mouth showed an unusual condition. Approximately one-quarter of inch of space intervened between each of the lower six anterior teeth. Each incisor was so loose, that it could easily be extracted with the fingers. The gums were extremely inflamed, swollen, and pus flowed from all of them. The slightest touch produced excessive bleeding. The lower lip was swollen to more than twice its normal size.

X-ray examination showed no foreign body, nor any abscessed areas about any of the teeth. Other tests beyond the one for vitality could not be applied, for the pain incidental to them was excruciating. All the teeth were vital.

Using a very fine blunt explorer, a search was begun into every pocket. The patient fainted twice, but was revived, and presently a piece of the skin of the apple, about one-quarter of an inch square, was removed from one of the sockets. This was followed by a rapid discharge of pus and then blood.

When the hemorrhage had been checked, ultraviolet rays were administered facially and lingually to the gum tissues of the affected parts.

The next day the condition of the lower jaw had decidedly changed. Most of the swelling had disappeared, the interproximal spaces had narrowed, to about one-half, the gums had lost much of the inflammation. Speech and movement of the jaw had become much easier and the patient was much more at ease.

Four treatments were given in all. Recovery was complete.

Case 2. Mr. D., aged 23, a musician, was referred by his family physician. He had not been feeling well for the last six months, several dentists had not been able to help him at all. He had practically given up all hope. His was the average case of Vincent's angina, badly and sadly neglected. He presented all of the symptoms of this disease, but what was most puzzling of all, was a wide open socket in maxilla. He had had an extraction only two days previously, of a molar. The dentist had claimed that because the arch presented a crowded appearance, the removal of this tooth would produce a cure.

A smear was at once taken and the diagnosis was confirmed. In less than a week, the severe symptoms were alleviated. Ultraviolet rays were the only means employed. The greatest amount of treatment centered in and about the open socket, so as to ward off any possible internal infection. In two months the mouth showed a complete return to normal and another smear

proved the entire disappearance of Vincent's spirochetes.

Case 3. Mr. A., about 30 years of age, post-office worker, presented himself with the upper lip badly swollen. The patient was in extreme pain, so much so, that the tears came rolling down his face. About a month prior, his dentist had inserted into the lower jaw a removable appliance in the nature of a lingual bar for the restoration of the lower posterior teeth. Shortly thereafter, the upper anterior right lateral had suddenly become very painful and loose. Two or three days later it had been extracted. In another week the same occurred with the upper left central, only this time the patient had objected to the removal of the tooth and the dentist finally consented to treat it. Upon his opening of the tooth, and with the discharge of a considerable amount of pus, the pain subsided. I do not know what other treatment was given later, but I was consulted for a repetition of this same trouble to the adjacent tooth, the right central.

X-ray examination showed both centrals to be abscessed, with no defined areas of infection or granuloma, a plain case of acute apical infection due to a pulpitis, which had been caused by trauma. A close examination of the bite or occlusal plane, showed that the dental restoration had acted as a traumatic agent upon the anterior upper teeth and was entirely responsible for what had occurred.

The denture was of course removed at once, and the right incisor opened on the lingual. The flow of pus and blood that followed, quickly relieved the pressure on the surrounding tissues and brought considerable relief.

Besides the right incisor, the left had been neglected and both had to be treated. At first the response to treatment seemed quite definite, the swelling gradually subsided, and the sensitiveness to percussion lessened. In about a week, the swelling returned, the lip again became puffed out and all the old symptoms reappeared. Ultraviolet rays were administered to the areas of the apical ends of these two teeth. For four days these treatments were given, until these abscessed areas became pointed, when it was a simple matter to open on the mucous membrane with the cautery and evacuate all pus. For a week or ten days, a fine thin rod applicator was directed into the sinuses thus produced, for about one-half inch. Each treatment was given for two minutes, each day. The canals of the teeth were then sterilized and filled, and a photograph showed a complete eradication of all pus and a return to normal.

Many similar cases can be described, some very unusual ones. They have become matters of fact. Success has not been due to mere chance or to the ordinary methods used in the past. Ultraviolet therapy has demonstrated its worth.

45 E. 17 Street.

Discussion

Dr. Oscar Wald (Brooklyn): This recently neglected and abused child "Physical Therapy," is today fully recognized, not only by the medical, but also by the dental profession.

From the beginning of history we find evidence that light, especially sunlight, was regarded as a very powerful healing agent. Herodotus and Hippocrates mentioned the therapeutic powers of sunlight. It is not by accident that the Egyptians and Babylonians worshipped their sun-gods amongst whom RA was pre-eminent. From the identification of heliotherapy with a deity, to a realization of well-being, was a step in the history of this most interesting curative weapon.

While we realize the beneficial healing powers of the sun, we must not confuse heliotherapy with ultraviolet light from an artificial source, like the quartz burner, air or water cooled, especially for local conditions. The sun at best will only give the longer wave lengths which are tonic, but when prolonged exposure is used, these rays being combined with other light rays, become more sedative and depressing to the human body and especially to the nervous system. The real curative rays are those of short wave length generated in quartz lamps which have a curative effect on diseased tissue, especially through quartz applicators transmitting these rays more readily than the air.

We know that the rays have a chemical action on tissues after they have been absorbed by them and by the blood. They activate the cholesterol in the skin and render it antirachitic. Calcium and phosphorous content in the blood is increased as is the growth of new cells, especially leucocytes, which aids in destroying infective and toxic agents in the blood and tissues. They have also germicidal properties.

Case 1, cited by Dr. Folstein is quite interesting, but any case of abscess formation, especially with addition of a foreign body would clear up rapidly after removal of the foreign body and evacuation of pus, which also will narrow interproximal spaces. We might give credit to the ultraviolet treatment for the reduction of time of healing, but we have to compare results with similar cases treated without ultraviolet.

In the case of Vincent's angina, it is gratifying to know how ultraviolet rays can turn an otherwise treacherous and trying case into a readily curable one, but it would be interesting to know the technic in this case, because usually the infection resides originally in the pharynx and the pillars must be retracted by a blunt retractor and then rayed, otherwise reinfection occurs.

In case 3, we have an interesting case of traumatic pulpitis cured by rational treatment, especially by the removal of the denture and opening and cleaning up the abscesses. But the application of ultraviolet to the apical abscess of the two central incisors before evacuating the pus with the assumption that the ultraviolet will help the abscesses to point, is not absolutely proper, since ultraviolet rays, especially the short

waves, will not act on pus cavities, since pus is opaque to these rays. I heartily endorse the continued use of ultraviolet after cleaning of pus pockets, because it promotes healing reaction and prevents recurrence.

I am quite surprised not to have heard a word mentioned about actual cases of pyorrhea cured by ultraviolet, as they are really most interesting and most stubborn cases to treat, especially by the technic enthusiastically advocated by Dr. C. M. Sampson.

Incidentally, I would warn everybody against the use of ultraviolet in any form, on cases of suspected diabetes, before securing a normal blood sugar. I also consider of value to precede ultraviolet treatments except in freshly bleeding wounds, with a heating lamp, like the thermolite, for ten to fifteen minutes, to increase local circulation and promote absorption of the ultraviolet rays.

In my experience all wounds and inflammations, especially of the oral cavity, are healed remarkably quicker by ultraviolet rays. It is especially noticeable after tonsillectomy, reducing the healing process to about one-third the usual time, so much so, that the patient can swallow ordinary food on the second or third day after operation.

Dr. Ginsberg (Springfield, Mass.): Regarding the statement about the use of infrared therapy before the use of the ultraviolet, I should think in hyperemia it would be quite difficult for the ultraviolet to penetrate. If you were able to obtain a local anemia, you would have a great deal of penetration of the ultraviolet.

Dr. Wald: Where pressure is necessary to reduce the blood circulation, the doctor is right, but where healing of wounds is necessary, healing of infection as in Vincent's angina, I think by promoting increase in circulation of the part prior to the application of ultraviolet, it is very beneficial, because the quicker the blood will absorb the ultraviolet rays, the better the reaction and more indirect germicidal effect in healing will take place.

Dr. London: Dr. Folstein, in presenting the first case, mentioned that he had taken an x-ray and after it happened the man bit the upper against the lower teeth and could not reveal any presence of skin in the upper.

Dr. Folstein (closing): I am sorry to say the x-ray did not reveal that foreign body. It would not because the skin of an apple is just about the same kind of tissue density and will not show under roentgenography. X-ray will only demonstrate a foreign substance of a harder density, such as of a metallic or osseous nature.

Dr. Jones (Troy, N. Y.): I should like to ask either one of the essayists if he can give us authentic information about the depth of penetration of ultraviolet ray. I have written to several manufacturers and received very technical replies, giving me information as to what ultraviolet has done on rats and human beings and pieces of paper and cellophane, and so on, but

nothing that I could apply in a practical manner.

Dr. Folstein: We have definite proof that ultraviolet can penetrate to about a millimeter, or, at most, two millimeters below the free surface of the gum, facts demonstrated by x-ray photographs.

Dr. Jones: In an unpublished paper I tried to show the penetration of therapeutic ultraviolet light of certain number of Angström units, but since an ultraviolet burner contains also shorter wavelengths, my results were conflicting although I could demonstrate penetration. I used one of my lighting intraoral x-ray films, on the inside of the cheek and placed a coin between the film and the cheek and exposed that from the outside with ordinary chromium lamp. I exposed the film and demonstrated the outline of the penny. I figured the thickness of the cheek was about a quarter of an inch. I want to stress that the value of ultraviolet radiation does not depend upon penetration as much as it does on absorption. The penetration of different wavelengths into various levels of the skin accomplishes its action by absorption in these layers.

Dr. Wald: Shorter wavelengths are less penetrating than the longer ones. They are stronger and more stimulating, but its action is more superficial. We know that if we use a good medium like quartz as an applicator, we can by pressure produce deeper penetrating effects, to an approximate depth of several millimeters. According to the photochemical law of von Grotthus and Draper, radiant energy to be effective must first be absorbed.

Dr. Asgis: No mention was made today of body irradiation in conjunction with local irradiation. Dr. Hill of England has pointed out that locally there is little value in ultraviolet ray, especially in pyorrhea cases, except when you follow it with body irradiation. English and German dentists use body irradiation.

Another point is the source. Mention was made of the short Angström unit rays, below 2000 and so on. I wonder why the various sources and particularly the "cold quartz" source has not been discussed as a means for dental therapy. This generator manufactures rays coming closer to monochromatic light than anything comparable in a practical sense. There is today authoritative literature on the subject which could well be studied by the dental profession with the promise of profitable therapeutic returns. I call your attention to the work of Hibben, Bachem and Behneman in connection with the therapeutic properties of the "cold quartz" generator. Such a comparative study would bring out interesting facts of great clinical value.

Dr. M. Frieberg (Brooklyn): Mention of body irradiation brings up the legal aspect of the limitation of the dentist in using ultraviolet in his practice. Are we legally permitted to use general body irradiation, and if so do we not conflict with the medical profession?

Dr. Weinstein (New York): A valuable point can be emphasized in the use of local ultraviolet

to an anterior tooth in which free drainage has already been established. Washing the cavity out with sodium eosin, 1:500, and irradiating the canal, penetration is accomplished because of the use of this photosensitive liquid. The eosin must be in high dilution to prove effective. In an upper central incisor with acute infection, and free drainage through the tooth, I inject sodium eosin with a syringe, flushing the entire rarified area and applying the quartz applicator at the opening of the tooth.

Dr. Folstein (closing): I should like to make it clear that an applicator is never applied to the opening of the tooth for treatment of abscessed teeth because you are simply wasting your time.

An applicator should be applied, in the treatment of abscessed teeth, to the tissue, mucous membrane in the area directly in the apical end of the tooth, and only in that way can you treat abscessed teeth. Your other method is absolutely assuming something and going at it from a wrong end. It is impossible to get any good, because in the first place you are not attacking the thing in the right manner.

In order to remove an abscess from around the end of a tooth, you have to treat it where it actually is. The abscess is not in the tooth. The abscess is periapically and if you are going to

direct rays into the mouth, first of all you get none of those rays beyond the apex because the apex is generally so constricted that it will allow none of the rays to penetrate. You know as well as I do that not only does a tooth have an apex or foramen at the apex, but it may have several foramina, not only through the tooth, but at angles to it.

Dr. Weinstein: I am saying without getting a sinus on the buccal surface or labial surface.

Dr. Folstein: You mean a fistula.

Dr. Weinstein: Yes, without getting an opening to apply a quartz applicator at the tooth also labially, and to cause increased circulation.

Dr. Folstein: We treat abscessed teeth even without fistula through the tissues and not through the opening of the tooth. You have to penetrate through the tissue and that is where you have to treat the abscess, on the very site and not in a round-about manner. The rays must work in the tissue periapically, not in the tooth proper. There you can employ chemical means to clear out chemically your entire tooth, and you are through, but that is not treating the abscess. The abscess must be treated periapically and only through direct radiation, the pressure being directly at the apex or apical tissues.

LOW VOLTAGE CURRENTS IN THE TREATMENT OF DISEASES OF THE NOSE, THROAT AND EAR

GEORGE B. RICE, M.D., F.A.C.S.

BOSTON

The low voltage direct galvanic current is sometimes called the chemical current, but no current is strictly chemical, for it may be partly mechanical in action, and to a slight degree, thermal. It has the power of breaking up chemical substances into component parts—one group moving toward the positive pole, and one toward the negative. This breaking up of compounds into minute particles is known as electrolysis, and the products of this decomposition are termed *ions*, which are electropositive or electronegative wanderers, seeking other ions that a union may be made, and a chemical equilibrium maintained. Ions are classified into anions, which travel toward the positive pole or anode, and cations, which travel toward the negative pole or cathode. An anion carries a negative charge, and a cation a positive.

Thus, likes repel; unlikes attract. Oxygen is electronegative, and is therefore repelled by the negative pole, and attracted to the positive. Hydrogen is electropositive, and is repelled from the positive pole, and attracted toward the negative.

The action of the positive pole on living tissue is in part sedative, vasomotor constrictive, and appears to relieve pain. The action of the negative pole is irritating, has a dilating effect upon the blood vessels, creates a hyperemia, and tends to soften and stimulate absorption of scar and fibrous tissue.

The positive pole will aid in controlling hemorrhage to a certain extent, and the negative will increase it. Their general polar effects have been tabulated as follows:⁽¹⁾

Positive Pole

1. Acid reaction.
2. Stops hemorrhage.
3. Sedative — relieves pain.
4. Hardens tissues and dries discharges.
5. Soothes inflammation.
6. Vaso-constrictor.
7. Germicidal.

Negative Pole

1. Alkaline reaction.
2. Increases bleeding.
3. Irritates.
4. Softens and liquefies.
5. Causes inflammation.
6. Vaso-dilator.
7. Non-bactericidal.

Pure water is a nonconductor of electricity unless certain chemical substances are added. These substances are then called electrolytes.

Useful chemicals for ionization are:⁽²⁾

At the positive or anode side:

Copper, zinc.
Lithium compounds.
Copper, zinc and magnesium salts.
Cocaine (superficial effect only).
Quinine.
Adrenalin.
Calcium chloride.

At the negative or cathode side:

Iodine and its various preparations.
(Lugol's solution, potassium iodide.)
Sodium Chloride.
Sodium salicylate.

The sinusoidal current is an alternating current, and has no polarity effect. It starts at zero; comes up to its full effect on the positive side, and falls back to zero again. The current then starts at zero, rises to the negative pole, and falls back again to zero, completing the so-called sine wave.

This current is capable of producing variable effects upon the soft tissues. It influences nutrition and metabolism favorably, and has a decided influence upon the nervous and muscular system. It relieves pain, and will help to develop weakened muscular tissue. Muscular fatigue follows its too prolonged use. It is contraindicated in acute and subacute inflammatory conditions.

In detail, the rapid sinusoidal should be

used cautiously. The slow sinusoidal for its muscle tonic effects, overcoming atrophic conditions. The interrupted rapid sinusoidal acts as a nerve tonic. The surging sinusoidal is indicated when deep penetration and strong contractive power is needed. The slow surging galvanic keeps its polarity, and therefore has a chemical effect combined with mechanical stimulation, and the combined galvanic and sinusoidal give a mild polarity effect and a mechanical action; while the so-called superimposed wave produces deep muscular contractions.

The practical application of these principles in the treatment of diseases of the ear, nose and throat is associated with very favorable effects. It has been my experience that too little attention has been given to the differential diagnosis of these pathological states. Treatments have therefore been instituted which could not by any possibility have produced curative effects, except psychical, and therefore brought physical therapeutic measures into further disrepute. I note, also, in general text books on electrotherapeutic treatment, that obsolete diagnostic terms are still in use and often symptoms are designated as fundamental diseased states. This seems to be particularly the case in connection with the specialties under consideration.

The Ear

Deafness: Two forms of deafness seem to respond well to physical treatment: (1) subacute inflammatory conditions of the middle ear following acute suppurative and non-suppurative affections; (2) chronic low grade infections of the middle ear, with changes in the mobility of the ossicles and tympanium, and not infrequently chalky deposits in the tympanic membrane. Elderly people are the greatest sufferers from this type of deafness. The symptoms are as follows: Membrana tympani opacity, perhaps calcareous deposits; immobility; retraction. Reduced lumen or stenosis of the eustachian tube is also an associated finding.

Spongification of the bony capsule of the labyrinth, or so-called otosclerosis, and conditions involving the eighth nerve or one of its branches, are but rarely if ever helped by physical measures. Cases often occur where mixed pathological conditions are

present, and here we can sometimes obtain fairly satisfactory results. It is of course understood that all possible corrections and examinations have been made in nasal and sinus abnormalities and the patient treated for any disorders found prior to physical treatments.

In this paper the high frequency current is not considered, although it is of decided importance in the treatment of a variety of affections to which the nose and throat are subject. In my practice it is in constant use, so that the use of the low voltage currents is usually preceded by from ten to twenty minutes of diathermy, using enough current to produce a comfortable heat, then the surging sinusoidal for five minutes on each side.

Pencil-like electrodes are then saturated with normal salt solution and held in place by a flexible head-piece. For both forms of electricity all that is now needed is to transfer the conducting cords from one generator to another. The surging sinusoidal seems to be the most comfortable, and the most effective modality in this form of deafness.

In chronic suppurative otitis media ionization is often effective. In my practice zinc sulphate 1 to 2 per cent is used. The formula is zinc sulphate 15 grains, glycerine 1 dram, water 7 ounces. This solution is isotonic with the tissue fluids, and osmosis is prevented.

The ear canals and middle ear should when possible be cleansed with peroxide or perborate of soda, suction, and drying with wisps of cotton. The patient is now placed in a recumbent position, with the affected ear uppermost, and a special hard rubber ear electrode with an active center introduced into the external auditory canal; the positive pole is connected to the ear electrode, the negative to the wrist or hand, and the current slowly turned on to one or two milliamperes for ten to twenty minutes. Should the patient complain of vertigo or pain the current should be gradually reduced.

Accessory Sinuses

Ionization is also of benefit in the treatment of chronic suppuration of the accessory sinuses. The technic as described by Cahille⁽³⁾ is as follows:

1. The insulated catheter is molded with plasticine and the latter smeared with vaseline.

2. With the patient lying supine on the couch, the plasticine and catheter are introduced into the nostril. A little manipulation molds the plasticine to the shape of the nostril.

3. The patient now turns to the prone position and rests his head on his forearm as a head-rest and makes himself comfortable.

4. A piece of narrow tape is passed through the loop of the catheter and fastened around the neck to keep it from slipping out of the nose, and to support the weight of the electrode and rubber tubing which are attached to the catheter.

5. The solution is turned on so that it fills one-half of the nasal cavity and overflows drop by drop from the other cavity. A basin is placed below the overflow. The indifferent electrode is fastened to the wrist, the active electrode connected to the catheter with a spring clip, and the current turned on. The catheter acts as an electrode and canula combined. By this method only one-half of the nose can be filled at one time, but each may be treated in turn.

For ionization of the antrum alone a much simpler technic is employed in my practice. The middle meatus is plugged full of absorbent cotton, the patient is seated in a chair with the head inclined well over on the side of the diseased antrum. I then introduce a catheter insulated with rubber tubing into the antrum, leaving about one inch of the curved end exposed. A four ounce piston syringe is filled with the zinc solution and introduced into the antrum. Now I connect the galvanic terminals—the positive one to the catheter and the negative to the hand electrode. The current is then gradually turned on to one or two milliamperes, according to the reactions, and the plunger of the syringe compressed so that a continuous dropping will take place from the nose or mouth. This is continued for ten minutes.

The symptoms of an acute or subacute frontal sinusitis are Ewing's sign +, that is pain on pressure with the finger in the inner angle of the orbit against the floor of the sinus. These structures are usually more sensitive in the early morning, and severe localized frontal headache is of frequent occurrence at this time. In purulent cases the morning aggravation is constant, and relief is usually experienced during the latter part of the day. In non-purulent congestive cases the periods of aggravation and relief are not as constant. Some writers term this a vacuum headache, due to closure of the frontonasal duct, and rarefaction of air causing dilatation of the blood vessels and pressure on sensitive nerve

terminals, together with retained secretions.

In cases of this character Waggoner⁽⁴⁾ suggests applying a weak solution of adrenalin chloride to the ethmoidal region and introducing the positive pole of the galvanic current into the nose in contact with the tampon, connecting the negative pole to an electrode placed on the forehead or chest, and using about three milliamperes of current for five minutes. The positive pole, as has been stated, causes contraction of the blood vessels, increases the contracting power of the adrenalin solution, and relieves congestion. Following the treatment the patient is told to compress the nostrils and swallow; a vacuum is thus formed, pus may be liberated and relief experienced.

In subacute or chronic laryngitis, after using the bi-terminal diathermy current by means of small flat electrodes—one each side of the thyroid cartilage, I follow up with the slow and rapid sinusoidal currents, from three to five minutes each, governing the strength of the currents by the patient's sensations. The gentle, electrical massage tones up the laryngeal muscles, and is particularly useful in vocal defects of public singers and speakers. It is also helpful in the relaxed condition of the larynx following an acute inflammation.

Strictures of the Esophagus

Drs. Jackson, Mosher,⁽⁵⁾ and others have made exhaustive studies of diseases of the esophagus, and to their investigations we owe much of our present knowledge. Jackson divides diseases of the esophagus into two classes, stenotic and non-stenotic. Stenotic diseases are classified into acute inflammation, neoplastic, spastic or cardio-spasm, and compression. Non-stenotic include diverticular, diffuse dilatation, paralysis and ulcerations. Our present interest is largely in the stenotic cases.

As has been stated in the early part of this paper, a good many years ago it was discovered that the negative pole of the galvanic current had the power of causing absorption and softening of scar tissue, and this made it possible to treat successfully certain cases of urethral and eustachian tube structures. Soon after this fact came to my attention I saw quite a number of cases of stricture of the esophagus due to traumatism. The accidental swallowing of

caustic potash was the most frequent cause. This was before the employment of the esophagoscope or x-ray in diagnosis. My only method of examination at that time was the soft filiform bougie and the timed swallowing test. With this I could get a good idea of the location of the stricture, diverticula if present, and the presence or absence of a neoplasm—either malignant or non-malignant.

I found that gradual dilation, first with the filiform bougie, and then with small olives—using the negative pole of the galvanic apparatus—in some cases brought relief. Later the esophagus and x-ray films came to be recognized as important aids in diagnosis.

My first and only case of injury in trying to dilate an esophageal stricture was at a later period. The patient was under ether, and the dilatation attempted by direct inspection, by means of an esophagoscope. In spite of this technic the wall of the esophagus was perforated, and a serious hemorrhage took place.

In the first edition of Dr. Jackson's book, published in 1907, he writes: "The use of the flexible bougie has no place in this book." In remote places it may, he says, as a makeshift yield information which could be obtained in no other way, and that examination should always be made under direct inspection.

I do not always anesthetize the esophagus unless the spasmodic condition is very pronounced. The olive tip electrodes are passed very slowly and carefully, and as soon as obstruction is felt the current is turned on to about five milliamperes, using gentle pressure, and holding it in position for as long a time as the patient will submit.

Treatments should not be repeated until all sense of discomfort has passed away; then using gradually larger sized olives from time to time as progress is made.

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A NEW HIGH FREQUENCY CUTTING ELECTRODE FOR TREATMENT OF CERVICITIS

H. E. KIMBLE, M.D.

CHICAGO

Cervicitis is the most frequent manifestation of all gynecological lesions. Its complications and sequelae are numerous. Only recently has the gravity of cervicitis received adequate emphasis. This has led to a marked improvement in methods of treatment, and the results obtained are far more satisfactory.

A small percentage of cases still are resistant to the present methods. They are the more severe varieties and need special consideration. By using a new electrode and technic this group has responded very satisfactorily to treatment.

The electrode (Fig. 1) consists of two in-

or combination of tips the cervical mucosa can be removed to any desired depth.

With this electrode the diseased mucous membrane of any cervical canal may be removed in long narrow strips. Six to twelve strips are usually sufficient, depending upon the size of the cervix. (Fig. 2.)

Technic

The usual preoperative technic is carried out. The cervix is grasped with a single tooth Volsella forceps. After the active end of the electrode is inserted to the internal os, the current is turned on by means of a foot switch. The cutting tip is pressed into

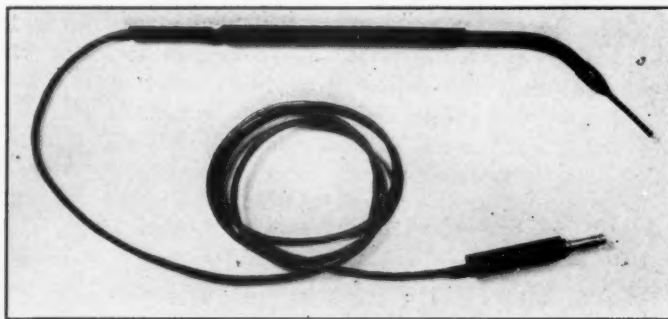


Fig. 1. Cervix electrode for electrical excision.

terchangeable cutting tips and a special handle. The handle is about ten inches long, the proximal six inches of which are rigid and about the diameter of a fountain pen, while the distal four inches are semi-rigid and capable of retaining any shape into which it is bent. The proximal end of the handle is fitted with a suitable adaptor for connecting with the terminal of a high frequency electrosurgical unit. The interchangeable tips are made of insulated silver rods two inches in length. At right angles to one end of the silver rod is a wire bent into an elliptical shape. The elliptical cutting wire on one tip is 2x4 mm.; on the other 3x4 mm. By using the proper electrode tip

the cervical tissue and then drawn toward the external os. A long narrow strip of tissue is excised. The tip is then re-inserted and a similar adjacent layer of mucosa is removed. This is repeated until the entire surface of the canal has been destroyed. Similarly, any erosion or diseased tissue on the portio can be resected.

When cutting on the lateral or posterior surface of the cervical canal the active tip of the electrode is kept parallel to the canal by bending the semi-rigid part of the handle.

Comment

1. In many cases a general anesthetic is necessary. For cases requiring general an-

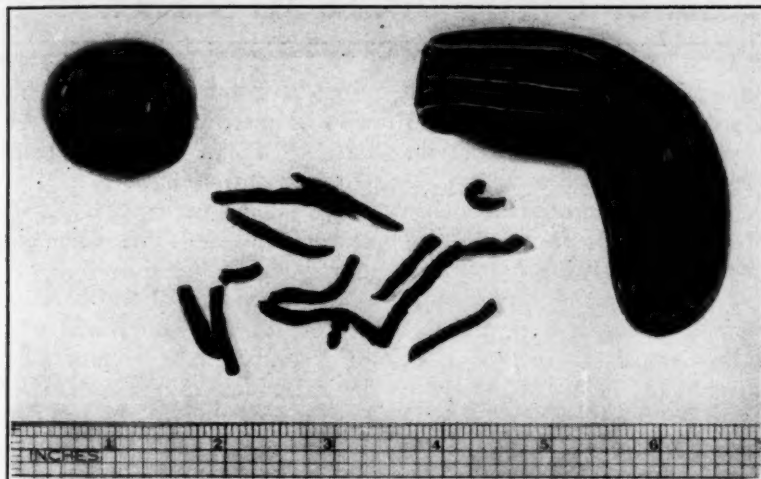


Fig. 2. Longitudinal section and parts of wax model of cervix showing how longitudinal strips of diseased tissue are removed, also strips of pathological tissue so excised.

esthesia, hospitalization is obviously required.

2. The method is one of dissection, making possible the removal of the diseased mucosa of the cervix without excessive destruction of normal surrounding tissue.

3. The strips of material removed are ideal for pathological examination.

4. Usually only one operation is needed.

5. There is practically no post-operative discharge.

6. Post-operative hemorrhage is minimized.

7. Although this electrode can be used in the treatment of cervicitis of any degree of severity, I have restricted its use in my practice to selected cases with excellent end results.

These selected cases were:

(1) Cases of cervicitis with extensive laceration, erosion and mucous discharge.

(2) Cases which had been subjected previously to some operative procedure.

(3) Cases which have marked scarring and stricture of the cervical canal following the use of cautery.

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WJY

EPITOME OF CONTRIBUTIONS TO SCIENCE IN 1933

The achievements in Science during 1933 have been so impressive as to single out this particular year as prolific in its contributions to civilization. It required *Science News Letters* to devote a special number (December 23) to list in abbreviated style the steady progress and activities in all branches of science. In the fact of a world economic depression, this prolific accomplishment is a remarkable index of man's intellectual supremacy over his material environment. The ten outstanding achievements in science were:

1. A new range of indications, greater flexibility and adaptability of short and ultra-short high frequency waves in therapy. The year 1933 has confirmed Professor d'Arsonval's early research of the therapeutic feasibility of high frequency oscillations up to 3 meter wavelength, and gives promise as one of the most revolutionary contributions in medicine.

2. Fluorescent ultraviolet radiation has brought to the front a new use of a certain octave of invisible light. Its possibilities as a diagnostic agent opens up an extensive field for research, useful both to medicine and its allied branches, and to the arts and industries.

3. Experimental evidence for the conversion of energy into matter, confirmation of the positive electron (positron), continued exploration of cosmic rays, continued development of high voltage electricity and attacks upon the atom.

4. Determination of the properties of heavy or mass two hydrogen isotope (deuterium) and heavy water containing it, new processes for making available sulfur, phosphoric acid, and other chemical substances.

5. Demonstration of multiple hormones of the pituitary influencing bodily activity, discovery of an antidote to bichloride of mercury, the development of surgical technic for complete removal of a lung.

6. More evidence that modern man is as ancient as some of the more primitive extinct human races, unearthing of ruins of the Athenian Senate's meeting place, excavation of a Persian royal palace at Persepolis.

7. Stratosphere flights in U. S. and U. S. R., a record round-the-world solo flight, a number of long distance flights.

8. Renewed explorations of the polar re-

gions, disastrous floods in China, the conclusion of meteorological research in the International Polar Year, the record of twenty tropical storms in U. S.

9. The beginning of a planned U. S. Agriculture, warfare against Dutch elm disease and grasshoppers.

10. Demonstration that the newborn can see objects and differentiate between degrees of illumination, development of a new physiological index to personality, discovery that apes are capable of the use of symbols.

Among the many important advances in science during 1933 were:

Applying ultraviolet rays to badly worn Egyptian monuments, an expedition from the Boston Museum of Fine Arts found it possible to reveal hidden inscriptions.

Using infrared photography, the British Museum restored to readable condition early Egyptian texts on leather and discolored Greek texts on papyrus.

Water can be made poisonous to protozoa by treating it with x-rays, three Stanford University scientists discovered.

Electrical changes accompanying nerve action are less abrupt in the brain than in the nerves, Prof. E. D. Adrian, Cambridge University, reported to the British Association for the Advancement of Science.

Sound vibrations far above the audible pitch coagulate proteins, crack vegetable oils, break down ethyl acetate to produce acetic acid and decompose starch to produce glucose, it was demonstrated by Dr. Earl W. Flosdorf and Dr. Leslie A. Chambers, University of Pennsylvania, carrying on previous research pioneered by others.

Sugar and starch are broken down into simpler compounds by ultra-sonic waves, Prof. A. Szent-Györgyi, Hungarian chemist, discovered.

Medicine

A leading subject of medical research during the year was the pituitary gland; evidence that it produces hormones affecting growth, sexual activity, sugar, utilization, milk production, and the thyroid and adrenal glands was presented and extraction of some of these hormones accomplished by investigators at McGill University, the University of California, University of Chicago, and the Rockefeller Institute for Medical Research.

The history of the functioning of an individual's pituitary gland throughout his life with all that tells of the individual's health and physical and mental development can be read in changes in his skull that may be seen in x-ray photographs, Dr. Hector Mortimer of Boston reported.

Protective "vaccination" against pneumonia

(Continued on page 53)

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EDITORIALS

MICRO-DYNAMICS FOR SHEKELS OF YOKELS

Common experience teaches that whistlers in the dark, brass instrumentations on parade, malapropisms in rhetoric, and the high fallutin, expressions of dreamers in the field of science are symbols of fear and inferiority complexes, used to create artificial courage or to becloud issues of simple demonstration. Lucidity and terseness have ever been the style of creative thinkers; phantasy and metaphysics those of the dreamer. In science the former method enabled the researcher to reduce his concept to simple mathematical formulae or laws, and has by that token pointed to truths so self-evident as to lift their contributions into acceptable theories or classical hypotheses. In contrast, the logic of the latter has always been reduced to absurdity. Experience applied to rigid facts and the orientation of these to precise formulae have been the motivating power of greater creative effort in science. The will-to-believe method of the metaphysician has raised faith to supremacy at the expense of experience.

Compare then the ways of the pseudoscientist, the false prophet and the charlatan, ways which always manage to take on or reflect the outer forms of science but never its essence. The crystal clarity of the former and the

muddy superficiality of the latter can well be exemplified by the striking renaissance of an incredible form of medical alchemy that promises to outrival even the mental excrescences of Albert Abrams, which is now making its bow to the medical profession under the high sounding name of "Micro-Dynameter." Mr. Ellis, who claims responsibility for its conception and birth, presents this anachronism for lactation by orthodox medicine under the guise that this new prodigy "Introduces a new band of therapeutic control," and of diagnosis so revolutionary that within 20 seconds it will tell on a calibrated scale the electrochemical condition of the patient and indicate not only the nature but also degree of his sickness. And to make assurance doubly sure that the remaining prop of one's incredulity is completely knocked from under one's conservative feet, Mr. Ellis points out that one can even "watch the action of a drug given in the body. In a few minutes its influence registers mechanically — shows its right and wrong effect hours or days in advance of symptoms."

Fortunately for those credulous in our midst whom Mencken may well have included under his satirical classification of "booboisie," the mantle of protective and guiding influence of the American Medical Association has frequently been responsible for shunting their

twilight therapies toward wholesome and proven fields of practice. Under the editorial caption, "Albert Abrams Redivivus," the *Journal of the American Medical Association* recently rendered another of its splendid services in defense of orthodox medical practice by calling attention to the report of its Bureau of Investigation on Micro-Dynamics. It pointed out the "exceedingly impudent attempt to exploit anew the electronic reactions of Abrams," suggestive of Barnum's optimism that for suckers one but needs to change old hokums for new to at once develop a new group of hallelujah shouters. The readiness with which a certain medical periodical lent its advertising pages for the exploitation of this pretender to medical practice, and an assembly for exhibition, was as much reason for the critical comment just mentioned, as the audacity of an electrical engineer to introduce "new wrinkles" in therapy. It says in part:

The Micro-Dynameter of Mr. Ellis has been exhibited at a meeting of the Inter-State Postgraduate Medical Assembly. A few of the physicians who derive their scientific pabulum through that organization have apparently invested in the device and thereafter been unable to find it of the scientific worthiness which at the time of investment it seemed to possess. Moreover, a so-called medical periodical, *Clinical Medicine and Surgery*, has aided promotion of the device through its advertising columns; indeed, Mr. Ellis flaunts a letter from the editor of that publication, Dr. George B. Lake, in support of his contentions. It seemed, when the late but not too greatly lamented Abrams passed from our midst — from pneumonia before he even hitched himself up to a machine — that his cult would pass soon from the scene. Usually these thaumaturgies disappear within a few years of the magician who promotes them. Little has been heard of Abramsism since that time and many a medical scrap heap yields the coils and wires that once were the heart and soul of the Abrams box. Yet now like a spirit from beyond the sepulcher emerges the Micro-Dynameter of Mr. Ellis. And a medical organization and a medical periodical are available to help rap the tables and shake the tambourines to assist the materialization. The spirit of Barnum must be chuckling beyond the Styx, unless perhaps exhausted by its laughter when viewing the multitudes who visited the india rubber man and the stuffed whale at A Century of Progress Exposition.

The ARCHIVES wishes it known that it voluntarily rejected business relations with this concern in the conviction of the unsound theories and practices they advocated, long before they were reported in the *Journal of the American Medical Association*. Indeed, the article by Schulhof appearing elsewhere in this issue reached us prior to the published con-

demnation by the American Medical Association. The critical analysis by Schulhof clearly demonstrates the absurdity and the clouded propaganda of Ellis as related neither to the flesh nor the spirit of science. Neither has it a relation to the orthodoxy of physical chemistry from which McDonagh derives his theories, and whom it poorly mimics. It is but another figment of an individual who is not able to differentiate reality from fancy, the factual from the ideal. And just as certain as the fool and his money is soon parted, so the yokels will soon be relieved of their shekels in exchange for a contraption that may calibrate the hay index of his cows or eructations of his clientele.

SPECIALIZATION VERSUS SPECIALISM

In the past few decades the tendency has been to increase the number of medical specialties, and through it the medical profession is in danger of leaning towards specialism rather than specialization. Entirely apart from the specialistic teachers in anatomy, physiology, chemistry, bacteriology, pathology, and the like, we have seen a great trend of dividing certain recognized clinical specialties into subspecialties. Time was, and not so very long at that, when even in the best American and European universities the teaching of general medicine, surgery, gynecology, obstetrics, and ophthalmology was considered adequate for graduation. The teaching was in the hands of one professor for each of the above-named branches of medicine who considered themselves lucky if they had a good assistant or two. Compare this modest beginning of a generation ago with the list of clinical teachers of every modern medical school. Internal medicine boasts of such subspecialties as cardiology, gastroenterology, neurology, with other branches, notably tuberculosis, metabolic and allergic affections, constantly gaining ground as special teaching subjects. Surgery, too, is regarded as too broad a specialty for one man, so that today we hear of abdominal, thoracic, plastic, genitourinary surgeons. Neurosurgery made its bow and received respectful recognition. The much ridiculed attempts to create the specialty of proctology, too, have gained their objective. Even in otorhinolaryngology efforts are not failing to create new dominions with bronchoscopy promising

to raise a flag of its own. This picture is, if anything, incomplete.

Coming to a form of specialization nearest our heart — Physical Medicine — we observe a similar trend towards specialism which merits reflection. Going back to the comparatively recent period of its beginning, we learn that science had to wrest hydrotherapy from a crude empiricism at the hands of laymen, not a few of whom were charlatans. Hydrotherapy would perhaps have risen to a "specialty" were it not for the need of institutions for its scientific employment. So much of it as could be applied in private practice by simple devices failed of popularity, possibly because of the simplicity of the measures and the stigma left on this method of treatment through its incompetent and unscrupulous sponsors. What primitive methods of electrotherapy were at first available, were restricted to neurologists and a comparatively few internists or general practitioners. Today the full use of aerotherapy, too, is virtually restricted to sanatoria, especially those which command good natural light for therapeutic purposes. Indeed, it is due only to the invention and development of apparatus producing artificial light that heliotherapy is now in use in general hospitals and private practice. These are but a few of the historic landmarks of the development of modern Physical Medicine.

Recently it was found that certain physical agents were effective also in a number of surgical diseases. Indeed, it is to the credit of a few pioneers in surgery that their experiments with physical methods have brought about a conservative therapy which has either freed countless sufferers from the risks of operative intervention or at least reduced the extent of mechanical surgery. We need only remind our readers of the great benefits derived from active and passive hyperemia in many surgical infections and of the beneficial value of fresh air and sunshine as therapeutic measures in surgical tuberculosis, to establish our case. As a result of all this our own Congress has felt the need of organizing special sections, including one on surgery. By this we do not imply that electrosurgery can be in any way identified with Physiotherapy. The removal of a carcinomatous breast by the high frequency current cannot by any stretch of the imagination be regarded as anything else than surgery pure and simple, as has been pointed out in the ARCHIVES on several occasions.

Nor, to cite another illustrative example, is the transurethral resection of a prostatic obstruction, anything else than genitourinary surgery. What we have in mind, therefore, is the utilization of physical methods which render operative surgery unnecessary or at least less formidable than has been the usual practice in the past.

The unprejudiced observer cannot fail to notice that there is a decided interdependence between Physical Medicine and general medicine and surgery, including their subspecialties. To proclaim Physical Therapy as an independent specialty means a false and fallacious trend towards an unwarranted specialism. The man holding himself out as a physiotherapist forgets that he has no specifics, in themselves sufficient to produce a cure in the majority of human ills. If he remain consistent and fail to employ other effective and legitimate therapeutic methods he reduces his standing to that of a mere technician, for he would then have to refer his clientele to other practitioners for whatever additional treatment may be needed. Fortunately the overwhelming majority of practitioners interested in Physical Medicine do not go to such extremes. They know that they are in duty bound to afford their patients the benefit of drugs, sera, vaccines, operative or orthopedic surgery, and they do not hesitate to combine all known measures with those purely physical in nature.

It follows that Physical Medicine as an independent specialty is impossible. That does not in the least detract from physical therapy, but on the contrary adds to its scientific status, but only as an integral part of General Medicine and Surgery. The definition of a learned man being one who knows of everything something and of one thing everything, may be applied to physical therapists with a certain modification. A good physical therapist is a physician who is at least as well grounded in general medicine and surgery as any other good practitioner and who at the same time possesses additional knowledge which enables him to derive the greatest possible benefit from physical therapeutic methods. Only under such a concept will modern physiotherapy become generally recognized as what it is — a valuable part of general therapy, which should not be neglected whenever there is an undoubted indication to attain the therapeutic ideal of *cito, tuto et jucunde* — a quick, com-

plete and pleasant cure. We should and must *specialize* in its methods without, however, falling into the error of unwarranted *specialism*.

PRELIMINARY ANNOUNCEMENT OF THE 13TH ANNUAL SCIENTIFIC SESSION AMERICAN CONGRESS OF PHYSICAL THERAPY

Once more your convention committee is at work. This time, it is to further plans for the 13th annual session, September 10, 11, 12, 13, at the Bellevue Stratford Hotel, Philadelphia.

A marked change is to be inaugurated in planning the 1934 program. The committee will shortly announce the numerous new features. At present diagrams for the commercial exhibits are being mailed out, and because of limited quarters for exhibition purposes, commercial houses are urged to make their reservations early.

The success of the annual sessions is in no small way responsible for the rapid progress made by the Congress. As the Congress now represents the majority of clinicians and teachers interested in physical therapy, the annual meetings are looked forward to for their instructional and educational value. The scientific papers are usually of a high standard and authoritative. The outstanding teachers and clinicians of the country are drawn upon for active participation in the programs.

The committee is desirous of familiarizing itself with original researches in physical medicine and solicits information from sources which are available for presentation of reports concerning newer developments. The preliminary program will be ready for distribution early in June.

1934 DUES PAYABLE NOW!

It is the unpleasant task of the secretary to call to your attention the necessity of paying 1934 dues promptly. If you have not already done so, please send in your check now.

The functions of the central office are multiplying as each year goes by. The increased cost of publication of the official journal and the many other services which the Congress renders, have added to the overhead of maintenance. The Congress could operate without embarrassment if the members would send in their dues checks early in the year. There is no better time to do this than *now*. Incidentally the Congress would save considerably in postage and clerical expense, and in these trying times, economy is important.

This same rule should apply to subscribers, who, after all, pay only a nominal amount for a highly specialized publication. If we could be assured of a more cooperative spirit — in the payment of dues and subscriptions — several additional valuable functions could be performed by our organization.

CAN WE COUNT ON YOUR COOPERATION?

CHANGES IN FORMAT OF ARCHIVES

By the time the reader has turned to this item, he will have noticed changes in the type of paper and the style used in the Abstract Section and in the references at the end of articles. The changes from the blue white high gloss to the cream-colored dull quality was a result of observations that the latter quality of paper reduces the incidence of eye strain and hence is more restful for reading purposes. The greater uniformity of type was also introduced for similar reasons.

Pacific Physical Therapy Association

The regular monthly meeting of the Pacific Physical Therapy Association was held at the Hollywood Hospital, on January 17, and the following papers presented:

1. "The Legal Aspects of Medicine," by William M. Rains, Attorney, Los Angeles.
2. "Mechanism of the Heartbeat," a moving picture, by Roy Manning, M.D., Los Angeles.

(Continued from page 48)

similar to smallpox vaccination may be possible as a result of the discovery by Prof. Arthur F. Coca, Cornell University Medical College, that pneumonia attacks may be warded off by hypodermic injections of the poison produced by the pneumonia germ.

A movement to prevent danger to the public health resulting from unsanitary food handling was started in New York City by a committee of public health experts.

An epidemic of encephalitis, said to be the worst in the history of the United States, occurred in St. Louis and vicinity in late summer and early fall.

A concerted attack by scientists of the vicinity, of the U. S. Army and U. S. Public Health Service and of various other institutions, including tests on convict volunteers, showed that encephalitis is undoubtedly due to a virus and is not carried by mosquitoes, that the disease can be transmitted to mice and that encephalitis patients develop immune bodies in their blood which give resistance to the disease.

Evidence strongly suggesting that a rabbit tick is the agent that has carried Rocky Mountain spotted fever across the continent was reported by Dr. R. R. Parker, U. S. Public Health Service.

A severe outbreak of plague was reported from Manchuria early in the fall.

A widespread but mild influenza epidemic occurred during the last weeks of 1932 and the first month of 1933.

With the admission of Texas to the death registration area, deaths are now recorded for the whole United States for the first time.

Seventy years was predicted as the expectation of life for future average Americans by Drs. Louis I. Dublin and Alfred J. Lotka, Metropolitan Life Insurance Co.

The causative virus of infantile paralysis travels from the nose to brain in the substance of the olfactory nerve cells whose branches lie exposed on the surface of the nasal mucous membrane, Dr. Simon Flexner, Rockefeller Institute, found.

Mortality from diabetes is increasing throughout the world and in practically all instances the increase is limited to women during and after the menopausal ages, Metropolitan Life Insurance Co. statistical analysis revealed.

One type of arthritis (hypertrophic or degenerative) results from the "wear and tear" of increasing age and from repeated injury to the joints, Drs. G. A. Bennett and Walter Bauer of Harvard Medical School, found.

One of the most remarkable feats in surgery was the removal of an entire lung from a three-year-old child suffering from cancer of the lung; the operation performed by Dr. William F. Reinhardt, Jr., Johns Hopkins Hospital, is only the second such ever performed and the first attempted on a child; the child is now well and living normally.

First surgical removal of an entire lung was performed on an adult patient in April by Drs.

Evarts A. Graham and J. J. Singer of Washington University Medical School, St. Louis.

Removal of the normal thyroid gland is a new method used by a group of Boston physicians and surgeons for relieving congestive heart failure and angina pectoris.

The severe pain of angina pectoris, heart disease, as relieved in six cases by cutting nerves, Dr. James C. White, Massachusetts General Hospital, reported.

Removal of tumors of the pancreas and of as much as seven-eighths of that organ itself was done by Dr. Evarts A. Graham of St. Louis to relieve a newly-discovered disease just the opposite of diabetes and due to overproduction of insulin and featured by epileptic-like attacks, mental symptoms, excessive hunger and weakness.

For the first time an operation was performed on a patient who was being kept alive in a respirator or "artificial lung"; the operation was performed at the Long Island College Hospital, L. I., N. Y., and the patient survived.

From the vital cortex of the adrenal glands Drs. Arthur Grollman and W. M. Firor, Johns Hopkins Medical School, extracted a crystalline substance so potent as to be considered probably the pure hormone.

A tentative chemical name for the adrenal cortex hormone and progress toward its laboratory synthesis were reported by Dr. E. C. Kendall and associates at the Mayo Clinic.

Evidence that the adrenal cortex has an influence on regulation of salt and water in the body similar to that of insulin on sugar was found by Dr. R. L. Zwemer, Columbia University.

Maintaining the normal volume of circulating blood was declared by Drs. W. W. Swingle, J. J. Piffner, and H. M. Vars, P. A. Bott and W. M. Parkins of Princeton University to be the vital function of the adrenal cortex.

Research of Drs. Frank A. Hartman, J. E. Lockwood and K. A. Brownell of the University of Buffalo showed that the adrenal glands appear to be concerned with vitamin utilization and milk production.

Progress in glandular treatment embraced successful treatment of seven cases of growth retardment verging on dwarfism by extract of growth-stimulating hormone of pituitary gland; relief from symptoms of premature old age in five women following removal of sex organs by treatment with theelin; and suggestion that Addison's disease may be treated more efficiently by the new adrenal-stimulating hormone of the pituitary gland instead of by giving adrenal cortex hormone.

Successful treatment of a bacterial disease (gonococcal vaginitis) by theelin, newly-crystallized female sex hormone, was announced by Dr. Robert Lewis of New Haven, Conn.

Nest-making, an "instinctive" activity of female rabbits, has been artificially provoked in them by injection of a commercial drug containing an active principle from the glands of pregnant women, Esther Bogen Tietz of Cincinnati reported.

The nature of the changes in the microscopic structure of the kidneys in certain types of neph-

ritis was observed for the first time by Dr. W. G. MacCallum, Johns Hopkins Medical School.

Victims of myasthenia gravis, a fatal disease characterized by general weakness, have been given new health and strength by two drugs, glycine and ephedrine, it was reported at the Mayo Clinic.

Dinitro-ortho-cresol and dinitrophenol were found to be powerful metabolic stimulants and weight-reducing medicines but several fatalities caused physicians to warn against careless use of dinitrophenol.

A close chemical relation between a female sex hormone, oestrin, and two of the most powerful known cancer-producing substances, two coal-tar compounds, was observed by Dr. J. W. Cook and Prof. E. C. Dodds, British scientists, who also produced in the laboratory a chemical compound having considerable oestrogenic action.

A reducing substance was discovered in cancer tissue by Dr. Leslie J. Harris of the Cambridge, England, Nutritional Laboratory; significance of the discovery lying in the fact that increase of reducing action is one of the most important characteristics of cancer tissue.

A substance capable of inhibiting the growth of certain forms of cancer cells has been obtained from chicken tumor extracts and from some normal tissues (placenta and embryo skin) was reported by Dr. J. B. Murphy, Rockefeller Institute.

Good results of treatment of certain cancerous diseases with continuous low-voltage doses of x-rays over the entire body were reported by Drs. Lloyd F. Craver and William S. MacComb, Memorial Hospital, New York City.

Cancer treatment by adjusting the content of various minerals in the blood is not justified on the basis of present knowledge, studies on the role of sodium, potassium, calcium and magnesium in cancer, made by Dr. M. J. Shear, U. S. Public Health Service, at Harvard Medical School, showed.

Successful treatment of bone cancer by colloidal arsenic was reported by Drs. A. C. Hendrick and E. F. Burton of Toronto.

A substance produced by the female sex glands is being used by Dr. H. Beckwith Whitehouse of Birmingham, England, to treat a precancerous condition of the breasts on the theory that the sex hormone slows up the activity of the pituitary gland, faulty function of which is considered by Dr. Whitehouse to be the cause of the breast condition.

An 800,000 volt x-ray machine, the most powerful ever put to practical use, was installed at Mercy Hospital, Chicago, for treatment of cancer.

Liability to cancer as such is not inherited; length of life and susceptibility to certain irritants are the only hereditary factors that can influence the development of cancer, studies of Drs. M. R. Curtis, W. F. Dunning and F. D. Bullock of Columbia University were reported to have shown.

The difference between cancer susceptibility and cancer insusceptibility involves one gene, Maud Slye of the Sprague Memorial Institute and the University of Chicago reported.

Experiments supporting the view that cholesterol prepares the soil for the growth of cancer by acting as an accumulator of light were reported by Dr. A. H. Roffo, Buenos Aires.

The cancer-producing constituent of coal-tar was found to be 1.2 benzylene by Drs. J. W. Cook, I. Hieger and C. Hewett of the London Cancer Hospital (Free) Research Institute.

New knowledge of the rare and puzzling disease, hyperparathyroidism, was gained through the courage of a patient which enabled medical scientists of Boston to discover, after seven operations, the cause of the disease in a mediastinal tumor of the parathyroid glands, the first such tumor ever found in that place.

Breakdown of the phosphocreatine mechanism of the body with resulting excessive excretion of creatine from the body is the basis for the muscular weakness of Graves' disease and of another condition, progressive muscular dystrophy, Drs. E. Shorr, H. B. Richardson and H. G. Wolff of Cornell Medical School and New York Hospital reported.

Death from a diet deficient in vitamins, minerals or other vital food factors is not simply a case of starvation, as previously thought, but may be due to other factors, such as faulty use of fats, which is the cause of death in magnesium deprivation, Drs. E. V. McCollum, H. D. Kruse and Elsa Orent, Johns Hopkins School of Hygiene, found.

Crystals of apparently pure vitamin B1, preventive of the Oriental disease beri-beri and other nerve disorders, were obtained by Drs. Atherton Seidell and M. I. Smith, U. S. National Institute of Health.

Scurvy-preventing vitamin C was prepared synthetically by Dr. T. Reichstein and associates at the Polytechnic Institute of Zürich, who obtained pure crystals of l-ascorbic acid, considered to be identical with vitamin C.

A case of scurvy in man was cured by injections of ascorbic acid, formerly called hexuronic acid and considered identical with scurvy-preventing vitamin C, Dr. Poul Schultzer, resident physician of the Copenhagen Municipal Hospital, reported.

Connection between diet and cataract of eye was reported by several investigators: Prof. H. K. Muller, University of Basel, Switzerland, reported experiments showing that lack of vitamin C might be a cause of cataract; Drs. Paul L. Day, William C. Langston and K. W. Cosgrove, Little Rock, Ark., and Dr. Arthur M. Yudkin, New Haven, reported studies showing that lack of vitamin G may be a cause of cataract.

Definite evidence of an anti-growth factor in the parathyroid glands was found by Drs. C. J. Eastland, N. Evers and J. H. Thompson of London.

Resistance to disease is an hereditary trait like color of eyes, hair or skin, studies with mice at the Rockefeller Institute for Medical Research showed.

(Concluded in Archives of February)

THE STUDENT'S LIBRARY

THE DIAGNOSIS AND TREATMENT OF POSTURAL DEFECTS. By *Winthrop Morgan Phelps*, B.S., M.D., Professor of Orthopedic Surgery, Yale University, and *Robert J. H. Kiphuth*, Assistant Professor of Physical Education, Yale University. Cloth. Pp. 180 with 107 illustrations. Price, \$4.00. Springfield, Ill., and Baltimore, Md.: Charles Thomas, 1932.

Preventive medicine today concerns itself with a large variety of topics concerning the health problems of the individual as related to the scheme of his environment. The present work is a highly representative and authoritative survey of defective posture and its correction, and is presented in such vivid, logical and clear style as to awaken the interest of all branches of medical practice in this problem. It is clearly pointed out that our growing interest in physical education has widened the field of our interest in the correction of postural defects because it is now recognized as an integral part of preventive medicine. Hence, it is our concern and particularly that of the practice of physical medicine to possess a clearer orientation of the factors associated in its manifestation and prevention, in order to adopt the proper measures to correct this widespread defect in the health of the individual. This has led the authors to a study of environmental and individual causes and to emphasize many of the contributory factors at the bottom of the problem. That it is a problem of vital importance affecting every age and the various levels of social order, is demonstrated with detail and unusual clarity in this study. The measures advocated are based on statistical studies drawn from examination of boys and young men, the pre- and adolescent types, afflicted with abnormal defects ranging from head to foot. The format of the book is gotten up in that pleasing combination of clear type and luminous illustrations found in all of the Charles Thomas publications. Its contents are divided into eight comprehensive chapters, plus an Introduction, a Summary, Bibliography and an Index. The work is one of the most rounded and authoritative discussions on a subject of interest to the entire profession.

DIET IN SINUS INFECTIONS AND COLDS.

By *Egon V. Ullman*, M.D., formerly Special Lecturer for Biology at the Oregon State College; Instructor at the First Medical Clinic at the University of Vienna; Demonstrator at the Laryngological Clinic (Prof. Hajek) at the University of Vienna; Assistant Physician at the Otolaryngological Clinic (Prof. Neuman) at the University of Vienna; Mem-

ber of the Research Staff of the State Serum Institute of Austria. Recipes and Menus by *Eliza Mez*. Cloth. Pp. 166. Price, \$2.00. New York: The Macmillan Company, 1933.

It has long been known that diet plays an important rôle in the management of many acute and chronic diseases. At times, however, too much emphasis is placed upon dietary regime by those who would cure all ills with this one method. The relationship of diet to upper respiratory infections is a contribution of modern research. The author presents this little volume because he writes: "However much we may have studied, written and read about nutrition, no intelligent and systematic application has thus far been made in this direction on sinus patients." The author states further: "Years of experience in this line and the urging of patients and friends have brought me to the conclusion that it would be the right thing to present my experience in the form of a book. No miracle should be expected. No one should expect to find a cure-all for any disease. There will always be patients who must submit to surgery. But in directing the methods of eating and living of all the many who suffer from colds and sinus diseases, we may contribute more to the improvement of conditions than by devising a new operation." Probably one of the more important chapters of this presentation is the second, devoted to giving general advice to people suffering from colds. The chapters following this one consider the part played by proteins, an alkaline diet, bread, potato, fruits, spices and spicy vegetables, fats, salt and calcium. Diet as a form of therapy should always be worked out by a physician who is familiar with the patient, as no arbitrary, routine program can be prescribed for all classes of individuals. The first part of the book deals with the importance of, first, the basic diet, and second, the effects of salt reduction, the latter being treated extensively from all possible viewpoints. The second part deals with foods, or more scientifically the application of a strict dietary regime and the preparation of foods for this purpose. An appendix gives about one hundred fifty recipes, which are a valuable aid to the patient carrying out the dietary program. While it would be extremely difficult to subscribe to all the views expressed by the author, no one now disputes that diet has a definite influence on the incidence, course and resolution of upper respiratory infections. With this in mind, rhinologists will, no doubt, pay closer attention to this problem, and in their suggestions to the patient, point out the importance of taking certain foods and abstaining from others. As the book is quite free from technical verbiage, it should prove helpful to the lay person sufficiently interested in modern problems involving our every day living.

CALCIUM METABOLISM AND CALCIUM THERAPY. By *Abraham Cantarow*, M.D., Instructor in Medicine, Jefferson Medical College; in Charge of Laboratory of Biochemistry, Jefferson Hospital; Assistant Physician, Philadelphia General Hospital. With a Foreword by *Hobart Amory Hare*, B.Sc., M.D., LL.D., Late Professor of Therapeutics, Materia Medica and Diagnosis in the Jefferson Medical College, Philadelphia. Second Edition, Thoroughly Revised. Limp Binding. Pp. 252. Illustrated. Price, \$2.50, net. Philadelphia: Lea & Febiger, 1933.

There has been an increasing interest in the subject of calcium metabolism "which has followed closely upon the discovery of the antirachitic factor and the parathyroid hormone." As a result of this greater interest a second edition of this small volume is timely. The author points out the fact that the literature dealing with the various phases of calcium metabolism makes it difficult to present, in a logical and correlated manner, those observations believed to be fundamentally sound and significant. Yet, in spite of this, the subject is rationally outlined and discussed in the light of our present knowledge. Normal calcium metabolism is considered in Part I and abnormal calcium metabolism in Part II. Calcium therapy is thoroughly detailed in Part III. There are ten chapters in all, consuming 214 pages, and this is followed by a rather complete bibliography. To authoritatively compile a book of this kind, one must of necessity be familiar with the laboratory and clinical aspects concerned. In both of these qualifications, Doctor Cantarow has demonstrated his knowledge and his discussions of the numerous phases, metabolic and chemical, have established calcium therapy on a sound and rational basis. There is probably no other treatise so complete and thorough, making it a handy reference for student and practitioners.

PATHOGENIC MICROORGANISMS. By *William Hallock Park*, M.D., Professor of Bacteriology and Hygiene, University and Bellevue Medical College, and Director of the Bureau of Laboratories of the Department of Health, New York City, and *Anna Wessels Williams*, M.D., Assistant Director of the Bureau of Laboratories of the Department of Health, New York City. Tenth Edition, Enlarged, and thoroughly revised. Cloth. Pp. 829 with 215 Engravings and 11 full page plates. Price, \$7.00. Philadelphia: Lea & Febiger, 1933.

The recent 10th edition of this well-known work stands as a noteworthy contribution to this phase of medicine and is a most complete and practical manual for students, physicians, and health officers. It is over 800 pages in length (829) and contains 215 engravings and 11 full-page plates. A unique feature of this book is that a large portion

of the information contained is based upon the original or collaborative work of the authors themselves. This fact, together with the systematic organization of the material presented, has deemed it worthy of being employed as a textbook in many of our medical schools. The book is divided into three major sections: The first part takes up the basic principles of the science of microbiology; the second microorganisms individually considered; and the third applied or practical microbiology. In addition, charts exceedingly complete in their nature are included which serve to make the book a very useful laboratory manual.

GROWTH AND DEVELOPMENT OF THE CHILD. Part II: Anatomy and Physiology. A Publication of the White House Conference. Cloth. Price, \$4.00. Pp. 629. New York: The Century Company, 1933.

This, the second volume in the series of four dealing with the question of growth and development of the child, is devoted to the anatomical and physiological aspects of growth. Thirty-seven authorities contributed facts and opinions which were reviewed by the Committee on Growth and Development. The contributors include such well known authorities as Carlson, Derby, Helmholtz, Scammon, Schaeffer, Streeter, Talbot, Todd, etc. Each of the anatomical and physiological body mechanisms is analyzed and its growth and development considered from conception to full maturity. The obstacles which interrupt and interfere with normal development are also discussed. Gaps in our knowledge are stated.

Regarding the thymus, emphasis is placed, first, on the roentgenographic determination of its size rather than the less reliable methods of percussion, and, second, on the fact that there are no generally accepted standards of average width of the thymic shadow and its normal variability. Reference is made to Barnes' Work which indicates that radiation of the thymus has no delayed detrimental effect on the child.

A section dealing with the clinical and roentgenological aspect of the respiratory tract states there is a need of roentgenologists skilled in the technic of child roentgenology and acquainted with the diseases of childhood. Stress is placed on the value of roentgenograms in children under 5 years of age in whom the physical examination often fails. A roentgenographic appraisalment of the skeleton includes a guide for age identification with a warning that the greatest difficulty will be found in its application between 7 and 9 years. Throughout the sections the reviewer was impressed with the clinical application of the anatomical and physiological information. The book is excellent for the pediatrician and a valuable reference source for the investigator.

INTERNATIONAL ABSTRACTS

The Use of Surgical Diathermy (or Endothermy) in Separating Pleural Adhesions in Cases of Pulmonary Tuberculosis. George L. Stivers.

New Eng. J. Med., 209:437, (Aug. 31) 1933.

The active electrode is a sharp-pointed instrument which is introduced through the cannula to the insertion of the adhesion on the chest wall. When the coagulating current is applied, the contact area is dehydrated. No heat is disseminated to the neighboring structures and its use occasions less pain than the galvanocautery. In using the endotherm knife for cutting, a different kind of electrical energy is used. A minute arc is produced at the point of contact of electrode and tissue. This produces intense localized heat and separates the tissues as in using a scalpel, at the same time sealing the minute lymph and blood vessels.

A high frequency current from the endotherm electrode is used to produce a zone of coagulation on the chest wall surrounding the band, sealing the lymph and blood vessels. Into this coagulated area the galvanocautery tip is introduced and the actual cutting or enucleation of the band from the chest wall is done. It seems to me that this combination of endothermy and galvanocautery gives the best results.

The room used for the operation is darkened, doors and windows covered by dark shades so that no ray of white light will disturb the surgeon while operating. A small ruby ceiling light is the only illumination that is used.

Following the introduction of the thoracoscope through the cannula into the pleural cavity, the lung, pleura and adhesions are minutely studied. It is important to examine closely the character, color, and consistency of the lung, the presence of possible exudate, and caseous nodes of the lung and parietal pleura. Then the adhesions are studied. Their exact location in reference to important organs within the bony thorax is defined, as well as their shape, size, tension, consistency and the presence of lung tissue or blood vessels. Illumination from the thoracoscope clearly outlines any pathological condition within the chest cavity and a study of the offending adhesions determines the point of introduction for the cautery or electrode.

The color of all adhesive bands is quite significant. The gray blue of lung tissue prolonged into the adhesion is easily discovered by direct light or by the use of the thoracolum placed in back of the band. The bright red of the blood vessels is defined usually at the edge of the band and is unmistakable. The white bleached-out appearance of a string or a membranous fan-shaped band denotes great tension, which is more pronounced as the band is being severed. Caseous exudate and areas of edematous tissue are very

prone to be present where there is tension.

In coagulating large adhesions it is advisable to use a comparatively weak current for a longer period of time rather than a stronger current for a brief time, for the latter current might occasion quick dehydration or even carbonization of the tissue. This would limit the field of desired coagulation and possibly be instrumental in the causation of secondary hemorrhage. With a small band a stronger and more rapid application of the current may be made with safety.

Studies on Physiologic Effects of Fever Temperatures: Thermal Death Time of Neisseria Gonorrhea in Vitro, with Especial Reference to Fever Temperatures. C. M. Carpenter, Ruth A. Boak, L. A. Mucci and S. L. Warren.

J. of Lab. and Clin. Med., 18:981, (July) 1933.

Carpenter and his associates determined the thermal death time of fifteen strains of the gonococcus in vitro at fever temperatures of 39, 40, 41, 41.5 and 42 C. (102.2, 104, 105.8, 106.7 and 107.6 F.). Seven strains had been under cultivation for twelve years, one for ten years and the other seven were isolated from one to four months prior to the experiment. The resistance of the strains of gonococci examined to the fever temperatures was variable. The cultures that were isolated ten and twelve years ago had, on the average, a longer thermal death time than the recently isolated cultures. At 39 C. there was little, if any, effect on the growth of the organism. At 40 C., about 99.7 per cent of the organisms were killed by an exposure of ten hours, while death of all the cells was not obtained at thirty hours in eight of the strains. At 41 C., 99 per cent of the gonococci were destroyed in from four to five hours, while death of all the organisms required from eleven to twenty-three hours. At 41.5 and 42 C., 99 per cent of the gonococci were rendered nonviable in two hours. The remainder were killed at 41.5 C. in from seven to twenty hours, while at 42 C. the thermal death time varied from five to fifteen hours. In all instances the recently isolated cultures, with the exception of one "old" strain, showed the least resistance to 41, 41.5 and 42 C. The in vitro thermal death time of the gonococcus is short enough at 41, 41.5 and 42 C. to suggest artificially induced fever as a valuable aid in the treatment of disease due to this organism. It is doubtful whether complete sterilization by heat can be obtained always from a single artificially induced fever of a duration of five hours. — [Abst. J. A. M. A., (Nov.) 1933.]

Poliomyelitis In Adults. F. Nagel.

Deuth. Med. Wochen., 59:1328 (Aug. 25) 1933.

Nagel's observations during the epidemic of poliomyelitis in Leipzig in 1932 showed that about 15

per cent of the patients were adults and that the adults contracting the disease were in greater danger, since their mortality rate was much higher than that of children. The author was unable to corroborate the observation that adults show more often an atypical course of poliomyelitis than do children; he found manifold symptomatology, but not more so than in children. He gives an outline of the typical course of the disease, which he thinks will aid in the diagnosis during the preparalytic stage, and he advises that even slight meningeal symptoms should be given careful consideration, but he does not think that the examination of the cerebrospinal fluid is of value for the differential diagnosis, nor does he consider the number of cells in the cerebrospinal fluid and the first extension of the paralysis a reliable basis for the prognosis. In discussing the treatment, the author mentions the various forms of serotherapy, the use of horse serum as well as of convalescent serum, and the intramuscular, intravenous and intraspinal administration. He shows how widely opinions differ in regard to the efficacy of serotherapy, and he cites one statistical report demonstrating conclusively that after serotherapy the incidence of paralysis as well as the mortality rate is higher than in cases in which serum is not employed. In view of his own experiences with serotherapy, he thinks that intramuscular or intravenous injections of serum or blood may perhaps be tried, but he advises against intraspinal injection of serum. He thinks that physical therapy is helpful for the improvement of impaired muscles. — (Abst. *J. A. M. A.*, 101:1437 (Oct. 28) 1933.)

Importance of Small Dosage in the X-ray Treatment of Leukemia. G. Harrison Orton.

Brit. J. Radiol., 6:242, 1933.

In view of the marked effect on the blood picture of very small doses of x-rays, large doses in the treatment of leukemia are unnecessary. When too large a dose is employed, cases of myelogenous leukemia are less likely to react adversely in the way of constitutional disturbances than the chronic lymphatic cases. In lymphatic leukemia, large and even moderate doses are not only advisable, but may actually be dangerous. Orton repeats the warning that the symptomatic improvement of the patient and the raising of the red cell count are far more important factors in treatment than any attempt to reduce the white cell count to within normal limits. When the white cell count has fallen to 18,000 or 20,000, further irradiation should not be attempted.

In cases of chronic lymphatic leukemia, provided the red cell count is kept up to normal, a white cell count of 30,000 or 40,000 is quite consistent with good general health. A reduction below 20,000 is not easy to obtain without adversely affecting the red cell count, and should not be attempted.

In both types of leukemia the risk of any super-added infection, such as influenza, is to be guarded against as far as possible, since such infections nearly always lead to a rapid relapse likely to prove fatal.

[Infections do not always cause a relapse. In a

number of examples of myelogenous leukemia an intercurrent infection has been seen to reduce the leukocytes to normal numbers, though afterward the count has again risen and the disease resumed its course.] — (Abst. *A. J. Cancer*, 19:500, (Oct.) 1933.)

Radiation Therapy In Medical Practice. Ernest A. Pohle.

Wis. M. J., 82:769, (Nov.) 1933.

The author summarizes his observation of the effectiveness of radiation therapy into the following categories:

1. Patients suffering from a primary carcinoma with tendency to skeletal metastases should be carefully examined by roentgen rays as soon as they complain of pain in a region of the body remote from the site of the primary involvement.

2. X-ray deep therapy properly applied will relieve the pain in at least 60-70 per cent of these patients and bring about healing of the carcinomatous process in approximately one-third if started early. Successful x-ray treatment of one bone lesion does not, however, prevent the development of metastatic lesions at other sites.

The Dawn of a Specialty In Medicine Allergy and Physical Allergy. W. W. Duke.

Ill. M. J., 64:174, (Aug.) 1933.

Heat and Effort Sensitiveness. Patients who are chronically highly sensitive to heat and effort have to reconcile themselves to a handicap and adjust their habits and occupations to degrees of heat and effort which they can tolerate. They have to avoid situations and climatic conditions in which they are likely to be overheated. They can frequently obtain relief by living in a cool, dry climate if they, in addition, avoid degrees of effort beyond their tolerance. A dry climate is often better for them than a cooler humid climate.

The immediate effect of heat and effort reactions can be very effectively relieved by cold and quiet. Frequently immersing the arms and hands in cold water is adequate. This does not always give immediate relief however, in cases of delayed reaction.

Agents which tend to keep body temperature at a high level usually give relief. The patients react most markedly when temperature is lowest so that the avoidance of gross subnormality in temperature is important. Temperature is inclined to be lowest in the early morning hours. Frequently a hot bath or exercise designed to raise temperature at midnight will prevent early morning attacks. Agents which cause fever, as a rule, relieve the condition temporarily whether the fever is caused by tonsilitis, pneumonia, typhoid fever, erysipelas or even as in one asthma case, by a lung abscess. Fever can be given artificially through the use of certain vaccines, especially *B. coli*, and occasionally the heat-sensitiveness case can be definitely relieved through the use of repeated doses of vaccines which cause slight fever.

Hydrotherapy is very useful in the treatment of heat and effort sensitiveness. In highly sensitive

cases it is very difficult to use heat without precipitating a reaction of some sort. Often a one second exposure to a hot lamp will precipitate a reaction which may result in a total loss of consciousness or a convulsion or result in twitching or violent asthma. For this reason heat and cold has to be applied in the beginning of therapy with great care. Frequently cold applied in a heat sensitive case will cause shivering and the heat generated by shivering may cause reaction. For this reason both heat and cold have to be applied with equal caution. In the beginning of treatment it is frequently advisable to give bromides or adrenalin or both one-half hour before treatment is started. Heat may then be applied for a few seconds or more or possibly a minute or so until the patient begins to react. Reactions should be stopped immediately by applying cool cloths to the chest, arms and legs or if the patient can stand it a rapid rub with ice on the chest, arms and legs. As soon as the reaction has ceased heat can be reapplied. This alternation of heat and cold can be continued at frequent intervals for a period of one-half hour and can be repeated daily and for a longer period of time as tolerance is gained.

Cold Sensitiveness. Patients who are sensitive to cold should be warned against exposure to cold which is beyond their tolerance. Certain ones can often be relieved through seeking a warmer atmosphere. This does not reduce their tendency to react to cold, however. Treatment with graduated gradually increasing exposure to cold gives a brilliant result in a large proportion of cases. This can be taken in the form of cold baths or treatment with heat lamps alternated with ice rubs. A cold bath should not exceed over fifteen or thirty seconds in duration and should be followed as a rule, by the drying and brushing of the skin with a stiff brush. An ice rub is a very effective method of treatment. If ice is moved rapidly enough over the skin it does not give rise to a disagreeable sensation of cold any more than a cautery gives rise to a sensation of heat if it is moved with sufficient rapidity. The entire body can be rubbed with ice within a period of fifteen or thirty seconds, in such a way that the patient need feel no sensation of discomfort from it. If this treatment is frequently repeated and gradually increased never exceeding the patient's tolerance, a high grade immunity to the effect of cold can usually be obtained.

One Hundred and Thirty-Five Cases of Wassermann-Fast and Neuro-Syphilis Treated With Diathermy and Modern Medication. Francis H. Redewill.

Urol. and Cutan. Rev., 36:367, (June) 1933.

1. A total of 135 cases were treated, 32 of which gave positive spinal Kahn test and are classed as cerebrospinal. The remaining 103 were Wassermann or Kahn-fast cases.

2. One hundred and thirty-five Wassermann-fast cases were treated. Forty-three gave a four-plus serum reaction before treatment was started and 20 of these gave a negative Kahn blood and spinal after treatment was completed. The remaining gave a two-plus Kahn, after receiving the average num-

ber of treatments. Forty-six cases showed a three-plus Kahn before treatment started and a negative Kahn blood and spinal after treatment was completed. Of the thirty-two cerebrospinal cases treated one had a severe venereal disturbance and did not complete the treatment. Eight exhibited mild optic disturbances, but not of sufficient severity to warrant discontinuing tryparsamide treatment. This was the only clinical manifestation of the cerebrospinal case in a restriction of the field of vision, without any apparent damage to the optic nerve. There are 26 patients in whom the disease has apparently been arrested and they have resumed their former occupations and earning capacity. One of this series is a semi-invalid (treatment was started after the development of hemiplegia, motor aphasia and mental disturbances); there has been remarkable improvement in his general health, as well as his mental activity and general attitude. His colloidal gold curve has changed from tabetic to luetic. He is able to walk, dress himself and comes unassisted to the office for his treatments. All cases are ambulatory. It has not been necessary to hospitalize any patient as a result of treatment.

Therapeutic fever heat treatments with the diathermy machine have aided so remarkably in the clearing up of Wassermann-fast cases, that all the dread, worry and tediousness heretofore encountered in the extended and unsuccessful management of that condition has been practically wiped out and the brightness of the luetic's future has been increased greatly. Of course, proper medication and management play an important part in this success.

Discussion on the Treatment of Chronic Suppurative Otitis. Section of Otology. A. R. Friel.

Proc. Roy. Soc. M., 20:1107, (July) 1933.

The factor which keeps up suppuration, and is common to all cases, is infection of the exudation or secretion by micro-organisms.

When a series of cases of chronic otorrhea is classified by taking into account the position of sepsis and presence of any other factor it will be found that sepsis, confined to the tympanum, and without any other factor, such as granulations or polypi, forms the largest group. In this class the area of sepsis is usually accessible. Suppuration, due to tympanic sepsis, would appear to be a condition suitable for treatment by antiseptics applied directly to the surface. Tympanic sepsis affords an excellent test for antiseptic treatment.

In the treatment of tympanic sepsis by zinc ionization, the ear is first cleansed and a weak solution of a zinc salt is inserted into the meatus. An electrode connected to the positive terminal of a rheostat dips into the solution, while the negative electrode is applied at a distant part of the body.

Consider the part played by the current. It makes the positive ion (zinc) travel towards the negative electrode, so that the film of infected material adficial cells of the mucous membrane. The introduction of the zinc takes place sufficiently rapidly for the treatment to be carried out in a reasonable time. The action of the current is selective, as posi-

tive ions alone are introduced here. No action on the tissues results from the presence of negative ions in the solution, for they are not introduced.

Consider the part played by the zinc: It is the antiseptic agent. It combines with albumin to form a dense insoluble precipitate between the subjacent tissues and the exterior. This antiseptic layer is not only a protective, but is a bad culture medium, and the micro-organisms present die. The zinc ion, when it has combined with albumin to form a precipitate, does not diffuse. Its action is confined to the depth to which it has been introduced and subjacent tissues are not irritated.

When the current is turned off and the solution has run out of the ear it is well in those cases in which the tissues were previously much congested to blow some boracic powder into the meatus. This prevents reinfection of any mucous or serum poured out while the congestion rapidly subsides.

The test of the treatment is the clinical result. The majority of cases in which the area of sepsis is accessible, and in which no other factor besides sepsis is present, cease to discharge after one treatment.

When other factors besides sepsis are present they should be removed before ionization and when the area of sepsis is only accessible with difficulty, special means must be used to gain access to it. When the area is totally inaccessible it must be made accessible by operation.

Therapeutic Fever Produced by Diathermy — Its Present Developments and Future Possibilities. **J. Cash King, M.D.**

Radiol., 20:449, (June) 1933.

The author summarizes his experiences as follows:

The value of febrile reactions as a therapeutic measure can no longer be denied. The appreciation of the ultimate consequences of this form of treatment is dependent on one's knowledge of the physiologic changes produced by hyperthermia, as well as an understanding of the pathology of the disease to which heat is applied. Diathermy has many advantages over other procedures previously used to bring about the desired febrile reactions. Better results have been made possible by the improvement in apparatus and technic. The results obtained with diathermic fever in paresis indicate that it is the treatment of choice at the present time. Pyrexia causes profound dilatation of the arterioles and capillary bed, which are the seat of the most active pathologic changes in syphilitic infections. By giving intravenous anti-syphilitic medication immediately before diathermy, we are able to combat the disease at a time when its pathologic processes are altered and the resistance of the treponema is lowered by the high temperature. Thus we hope to cure the disease in its incipency, or at least to prevent the serious complications of latent syphilis. The improvement observed in chronic arthritis so far has been most encouraging. We attribute this to the

changes in the existing pathologic process brought about by the reactions to fever. In gonorrhea, diathermy combats the progress of the disease by the bactericidal effect of heat and through the increased vascularity, which hastens resolution of chronic processes. The proper application of the treatment in the female has brought gratifying results, but thus far its use in the male has not been so encouraging. Although a distinct improvement in symptoms is to be derived from the use of diathermy in the treatment of thromboangiitis obliterans, bronchial asthma, multiple sclerosis, and chorea, the results obtained up to now are not commensurate with those secured in the above-mentioned diseases. We are hopeful, however, that future developments in technic will contribute to a greater success.

Energy of Radiation.

Comment in Penn. M. J., 35:856, (Aug.) 1933.

Prof. Friedrich Dessaur of Frankfort-am-Main, Germany, claims that radiation like roentgen rays or the gamma rays from radium, that destroy harmful growths in the body, or sometimes injure normal tissues, accomplish these results with small amounts of energy. According to Dr. Dessaur, a spoonful of hot tea brings more energy into the body in the form of heat than all the radiation reaching the inner tissues in a carcinoma treatment. Dr. Dessaur, from this fact, infers that the work of such radiations is done practically at the instant of impact, before the radiation has had time to become dispersed. He assumes that the primary result of any radiation is regularly to free an electron somewhere, and that such an electron discharged from an atom and wandering around with a protein molecule should be expected to cause inner vibrations in it. Described in other words, the one individual molecule hit by the radiation has been raised to a higher temperature, and the actual cause of the destructive effects of radiation is termed "point heat."

New Technic Designed for the Electrocoagulation of Vascular Tumors. **A. F. Tyler.**

Nebraska M. J., 18:6, 1933.

The author describes a technic for electrocoagulation that is used especially for vascular tumors. It consists in the use of two-pointed active electrodes placed in contact with the tissues about 1.5 cm. apart, so that the high-frequency current is short circuited between them. A current of one million to one million eight hundred thousand frequencies is used, as higher frequencies "cut too much and coagulate too little." A coil machine of low frequency and high amperage is employed; none of the radio tube types of machines furnishes a current with sufficient coagulating quality. With this technic a very intense heat is generated between the two electrodes, "congealing" blood in the large vessels and vascular spaces before the walls are opened. — (*Abst. A. J. Cancer*, 19, (Oct.) 1933.)

IRRADIATED ERGOSTEROL — CLINICAL AND EXPERIMENTAL STUDIES *

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Seven years ago I presented before this body a paper on the physiological effects of radiations.⁽¹⁾ While there may seem to be little relation between that work and the present subject, the more recent work is actually but a continuation of the investigations upon which the earlier paper was based. It became apparent that the problem of the effects of radiation on the animal organism could best be studied by turning to more fundamental intrinsic processes, one of the most important of which is the control of mineral metabolism. The phase of mineral metabolism most easily studied by experimental methods and most intimately related to this problem is the calcium-phosphorus complex.

At that time this factor could be most readily altered experimentally through the parathyroid apparatus. This approach, however, yielded little information having a direct bearing on the fundamental problem. When irradiated ergosterol was made available, therefore, further efforts were directed toward determining the nature of the effects of this substance on physiological processes.

There are three general methods of approach to this problem. The earlier method used by investigators was the balance experiment in which the effects of irradiated ergosterol on the retention and elimination of calcium and phosphorus were determined. The most widely adopted method, however, is the study of the effects of irradiated ergosterol on the concentration level of various constituents of the blood. The third method is the study of the influence of this substance on the rate and extent of fixation of minerals in the tissues. Supplementary to these procedures we have in our laboratory made some progress toward the study of the interrelations between

the mineral salts and the metabolism of various organic substances.

The first method is limited in its application since it yields little information about the more fundamental processes. The second method as usually applied only indicates the level at which mineral exchange is taking place between the blood and the tissues, but tells nothing of the actual rate of exchange. That is, electrolytes may be passing rapidly between the blood and tissues and yet the actual level of concentration in the blood may not be altered. Then too, there is the problem of the state in which mineral elements, particularly calcium, occur in the blood, about which the usual method of blood study gives no information.

For example the gross calcium concentration *may* not be altered in the least in clinical tetany due to parathyroid deficiency. Apparently, however, there is a profound change in the state of calcium, or in its relationship to other minerals or in the rate of transfer between blood and tissues, or in all three.

There are limitations also to the information obtainable by the third method. In the first place it tells nothing about the permanence of deposition of minerals in the tissues, usually nothing about the state in which they are deposited, and nothing of the local influences determining distribution within a given tissue or organ. For instance, why do tissues indistinguishable microscopically and physiologically, such as the walls of the two ventricles and the interventricular septum vary so widely in their mineral content?

There have gradually developed two ideas regarding this general problem which seem to me to have retarded progress. When it was first demonstrated that the parathyroid glands normally influence calcium metabolism, investigators generally were guilty of harboring, whether consciously or not, the erroneous idea that these glands are concerned only with this process and that they constitute the specific

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* The expenses of the work reported in this paper were largely supported by a research grant from Mead Johnson and Company.

control of calcium metabolism. The general trend of evidence accumulating in recent years I think indicates clearly that neither of these conceptions can be correct.

Another erroneous idea that flourished for a time only to lose favor with further accumulation of evidence is, that mineral metabolism is primarily controlled by physico-chemical processes in the blood stream itself. While the importance of these processes must not be minimized, it is clearly evident now that processes outside the blood stream are quite as important as those occurring in the blood itself.

There is much evidence that other endocrine organs normally exercise considerable influence on mineral metabolism and that the parathyroid glands are only a part of a general system of control in which the autonomic nervous system plays a vital rôle.

It would not be profitable at present to attempt to review all the evidence supporting these arguments. My main purpose is to present some experimental and clinical evidence based upon these views.

One of the earliest problems arising from the discovery of the calcium-controlling power of irradiated ergosterol was the nature of its influence on the parathyroid apparatus. Laurens⁽²⁾ has given an excellent review of the experimental evidence bearing on this point. That irradiation, cod liver oil, or irradiated ergosterol have a definite protective action against parathyroid deficiency is now well established. That the parathyroids are somehow involved in rickets, against which radiations, cod liver oil, and irradiated ergosterol have a specific protective effect, also seems well established.

There are two points of view as to how irradiated ergosterol accomplishes its effects. Taylor and his associates⁽³⁾ are definitely committed to the view that the effects of viosterol within therapeutic ranges are exerted through stimulation of the parathyroids. Much evidence has been accumulated in support of this view.

In our laboratory experimental evidence has been derived which seems to controvert this view, at least in part. In one series of experiments five dogs were parathyroidectomized and paired with five normal dogs of the same sex and comparable weight and physique. Each of the five parathyroidectomized dogs developed severe tetany that usual-

ly became progressively more severe with each attack.

The following protocol is typical of the entire series:

Dog No. 67, 18 lb. wt. was not treated in any way until the fourth day after the operation. He was then given intravenous injections of parathormone sufficient to restore blood calcium to approximately the level maintained before the operation, i. e., 11.20 mg. per 100 cc., two weeks later. At this time the normal control, 19 lbs. wt. showed a plasma calcium concentration of 10.50 mg.

Each dog now received an intravenous injection of viosterol 10,000 X, 0.5 cc. The blood was examined at intervals. The results are shown in Figure 1.

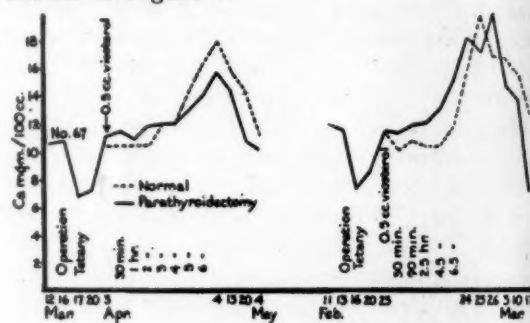


Fig. 1

Except in minor details the two curves are indistinguishable. It has been contended that the protective effect of viosterol in parathyroid deficiency is due to stimulation of accessory parathyroid tissue. However, it is scarcely conceivable that in five such paired experiments, the same dose of viosterol could produce so nearly identical degrees of stimulation when the amounts of parathyroid tissue must vary greatly between the two groups of animals. Obviously, then, some other mechanism of control of calcium must have been involved. In fact the increase in the total calcium concentration seems to begin at an earlier period in the parathyroid deficient animal than in the normal.

In Figure 2 are shown graphically the results of a prolonged experiment on a dog which was given a daily intravenous injection of 0.25 cc. of viosterol 10,000 X over a period of one month. After a rest period of a week parathyroidectomy was done. Determinations of ultrafiltrable calcium shows that this fraction was increased to some extent before the operation but even more markedly

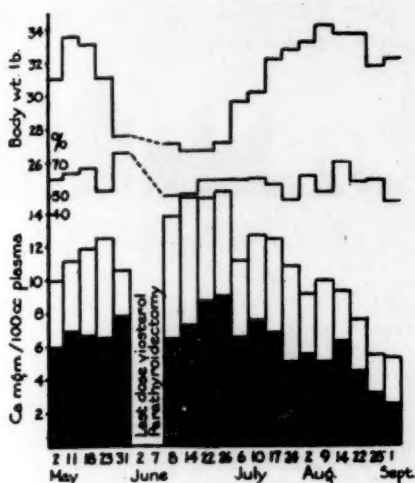


Fig. 2. Viosterol 10000 X, 0.25 cc, by intravenous injection daily, begun on May 2nd, to June 2nd. Black segments indicate ultrafilterable calcium. Lower single line indicates percentage of total blood calcium that is ultrafilterable.

during the month following. In more than three months since the operation there has appeared no evidence of tetany in spite of the extremely low figures for total and diffusible calcium. It will be noted, also, that the total calcium was increased following the operation.

In a still earlier series of experiments we have studied the effects of continuous tetanization of the vagus nerve at an intensity that did not affect heart rate or blood pressure, on the concentration of blood salts⁽⁴⁾. These experiments were too limited to permit of any conclusions other than that such a control is possible and probable. How it is accomplished remains to be determined. (Fig. 3.)

Another interesting problem is the nature of the toxic action of viosterol. Hart and his associates⁽⁵⁾ have recently reiterated what has been a common claim, that toxicity is directly parallel with hypercalcemia. Our experience prompts us to question this alleged parallelism. Normal dogs have been viosterolized to the point of death without any evidence of hypercalcemia. On the other hand we have found both dogs and human subjects tolerating a hypercalcemia of 30 mg. per 100 cc. for weeks without any evidence of toxic action.

These experiences naturally led to a study of the use of viosterol in postoperative clinical tetany in human subjects. In a recent publication⁽⁶⁾ we have given a detailed account of our experience with ten such patients. A less complete study has been made on four others not included in that series.

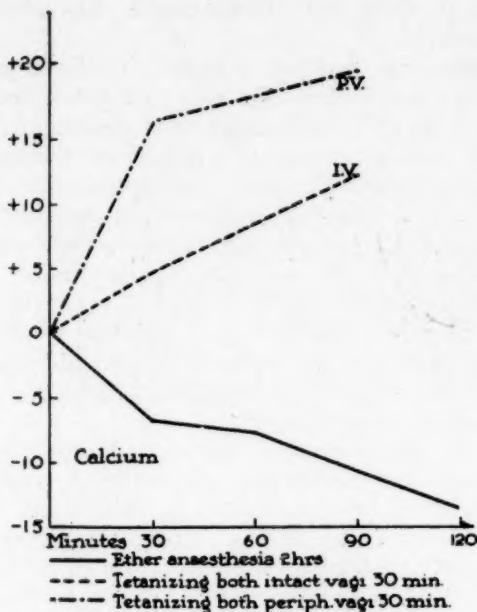


Fig. 3. Figures on ordinate represent percentage of change from the initial level. Each graph is a composite of 20 experiments on dogs.

(Reproduced from "Lipow, Reed and Weaver" (4))

The observations have now been extended over a period of three years in some cases. From these we may conclude that viosterol is of value in carrying patients over the early stages of postoperative tetany into the stage of latent tetany; also, that the long standing chronic cases that have become immune to parathyroid extract or calcium therapy may be benefited greatly.

Instead of establishing tolerance to this substance as is often the case with parathyroid extract and calcium salts, it has been found possible in eight of the fourteen cases, that is, in all of those in which the condition was of two or more years duration, to gradually reduce the amount necessary to control tetany. In fact four of the eight have found it possible to discontinue the treatment entirely during the past ten months.

These four are not entirely free of tetany, but do not suffer any particular inconvenience and do not find any increase in severity.

Of the other six cases, all of whom were treated within six months after the operation, two have been lost. The fact that they have not returned for any further treatment suggests that they are no longer troubled. Of the remaining four, three appear to be entirely free from tetany, or any other disturbance associated with parathyroid deficiency.

All of these have discontinued the use of viosterol.

One has suffered a vague, indefinite nervous disturbance, which may or may not be related to the thyro-parathyroid deficiency. In any case she does not suffer from tetany.

One observation that is at variance with the results of animal experiments on parathyroid deficiency is that chronic tetany in these clinical cases is not necessarily accompanied by hypocalcemia. Another, that the alleviation of tetanic symptoms by the administration of viosterol may be accompanied by increased calcium concentration, by a decrease, or by no demonstrable change.

In one case of seven years duration, our first blood examination showed a hypercalcemia of 13.50 mgm. per 100 cc. and yet the patient was suffering from violent tetany. With the administration of viosterol of high potency, the condition was promptly and progressively improved and the blood calcium concentration was reduced to approximately 10 mgm. per 100 cc. from which point it has not varied more than 2 mgm. in 22 months.

One other line of experimental investigation which seems to us to be in opposition to the theory that viosterol effects result solely from stimulation of the parathyroids may be mentioned briefly⁽⁷⁾. Three years ago we began a study of the effects of this substance on general metabolism in normal dogs. The results of these experiments have only recently been published. It was found that any dose approaching the toxic range would greatly accelerate the rate of oxygen consumption. In balance experiments conducted simultaneously we were unable to demonstrate any direct relationship between this effect and the amount of viosterol administered, or the degree of calcium mobilization, or on nitrogen metabolism. (Fig. 4.)

However, in a later series, the results of which have been published only in brief, it was found that when the dogs had fasted from ten days to two weeks there was an increase in urinary nitrogen output that closely paralleled the increase in metabolic rate. Apparently in the animals fasting for only 24 hours before the test, the effects on nitrogen metabolism were masked or compensated for in some way by the diet. But in the continuously fasting animals there was a definite acceleration of basal nitrogen elimination. (Figs. 5, 6.)

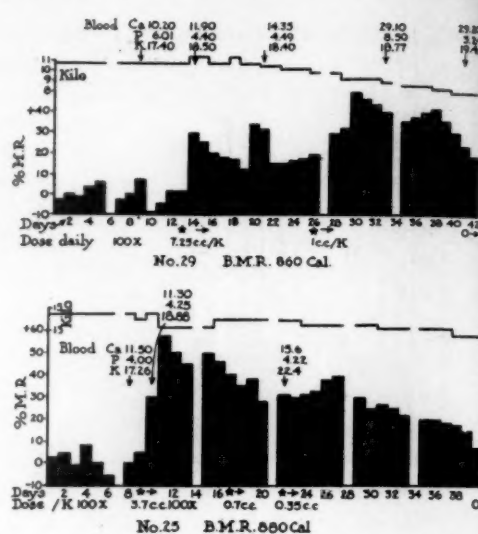


Fig. 4. The effect of viosterol on the basal metabolic rate of normal dogs. (Reproduced from "Reed, Thacker, Dillman and Welch" (7))

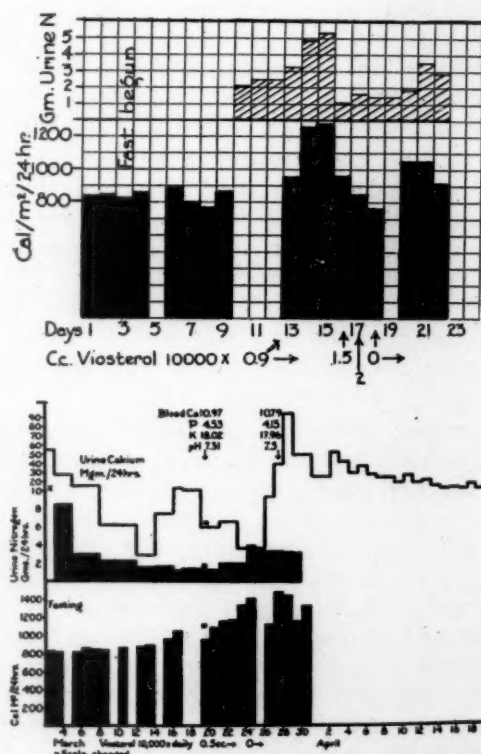


Fig. 5 and 6. The effect of viosterol on the metabolic rate and urine nitrogen output of a normal dog fasting for two weeks.

In another study, as yet unpublished, it was found that the administration of parathormone in any amount up to 10 cc. daily, not only did not increase the metabolic rate, but

actually seemed to decrease it to some extent. This study included five normal dogs. (Fig. 7.)

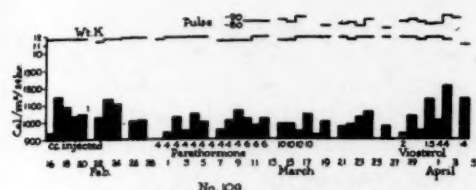


Fig. 7. The effect of parathormone and subsequently of viosterol on basal metabolism of normal dogs.

Clearly, then, activated ergosterol exerts other effects than those on calcium and at least some of these effects are not due solely to hyperparathyroid activity. Further investigation is necessary in order to explain some of these results.

At the stage when we were still unacquainted with all of the facts discussed above and we believed that any dose of viosterol would result in hypercalcemia, we became interested in an attempt to disprove the theory that a disturbance in calcium metabolism is an accompaniment of such allergic conditions as hay fever, by administering this substance to hay fever patients, believing that if hypercalcemia resulted and the patients were not benefited it would be clear evidence against this theory.

During the summer of 1932, in collaboration with members of the clinical staff, we undertook to make an intensive study of six hay fever cases under treatment with viosterol. The details of the study are given in a recent publication⁽⁸⁾. This study has been extended and elaborated during the current season on a larger series of cases, numbering nearly 300.

A few illustrative protocols are selected which are typical of most of the cases so treated. The most significant finding is that hypercalcemia is not a requirement for beneficial effects. Viosterol apparently acts on some other factor. Another significant point is that the general level of the potassium content of the blood is lowered and the relation between calcium and potassium as expressed by the K/Ca ratio is stabilized. Expressed in another way, the ratio is generally lowered and ceases to fluctuate so markedly. (Figure 8.)

In one hay fever case it has been found that the ultrafilterable calcium was lowered (Figure 9) markedly on the days when at-

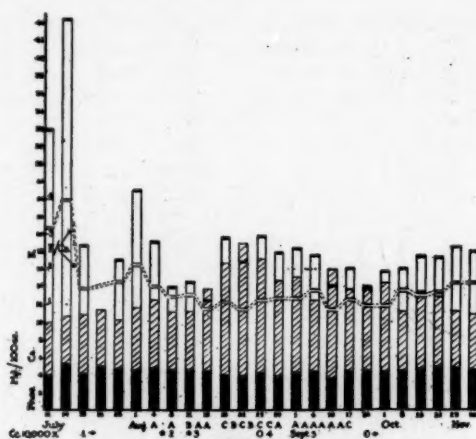


Fig. 8.

1. 0.5 cc 10000X Viosterol by mouth daily.
2. Dose increased to 1. cc daily.
3. Dose reduced to 1.5 cc daily.
4. Dose at 6.5 cc daily.
5. Discontinued viosterol permanently.
6. Slight itching of nose. Very mild hay fever symptoms.
7. Nausea, apparently due to overdosage.
8. Slightly more severe symptoms of hay fever.

Fig. 8. Black segments, inorganic phosphorus of blood plasma; cross lined segments, total blood calcium; plain columns, potassium; open double line K:Ca ratio. (Reproduced from "Rappaport and Reed" (8))

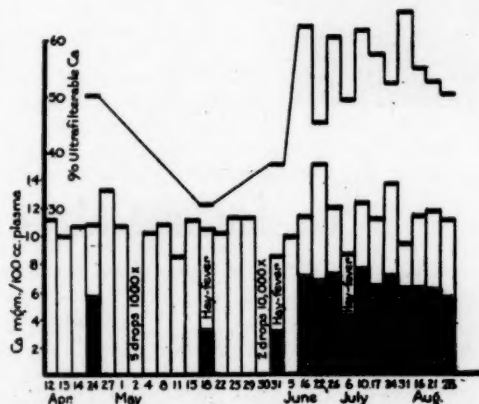


Fig. 9. The effect of viosterol on the ultrafilterable calcium in a case of hay fever. No pronounced symptoms at any time except on three days indicated.

tacks of hay fever occurred, in spite of treatment with viosterol.

In one case of asthma due to inhalation of cat hair, viosterol treatment definitely decreased the severity of attacks experimentally induced. In two similar cases no definite protection was found. Yet in all three cases the administration of viosterol induced the same sort of change on the blood chemistry. (Figures 10, 11, 12.)

In one uncomplicated hay fever case, a girl 16 years of age, treatment with viosterol during the season of 1932 resulted in complete

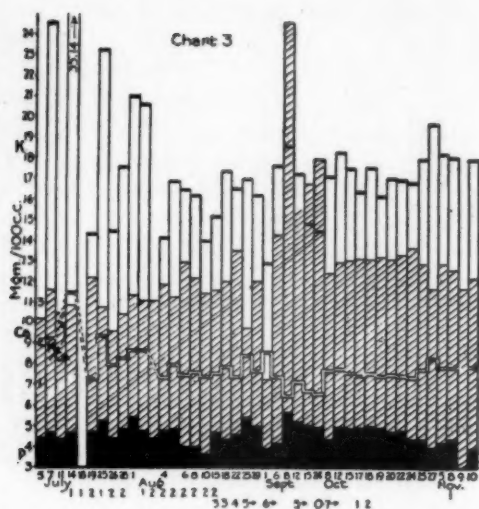


Fig. 10. A case of cat asthma. Attacks induced on days marked 1. Residual symptoms present on days marked 2.
3. Viosterol 10000X, 1.5 cc daily by mouth.
4. Reduced to 1 cc daily.
6. Increased dose to 1.5 cc daily.
7. Reduced to 0.3 cc daily.
Induced attacks after October were much less severe at all times.

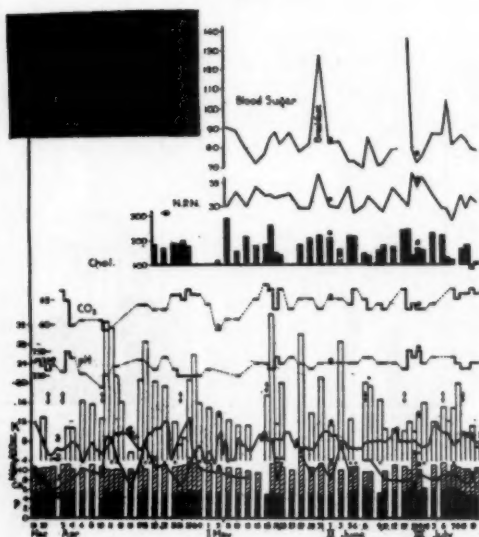


Fig. 11. A case of asthma due to rabbit fur. Attacks induced.
I. 0.1 cc viosterol 10000X daily.
II. 0.25 cc viosterol 10000X daily.
III. 0.5 cc viosterol 10000X daily.

protection. During the season of 1933 she has taken no treatment of any kind and has experienced only one day of severe hay fever, which gradually disappeared during the three subsequent days. Five other cases definitely benefited by viosterol treatment during 1932, have all experienced during 1933 definite symptoms of such severity that treatment has been necessary in each case. The prepon-

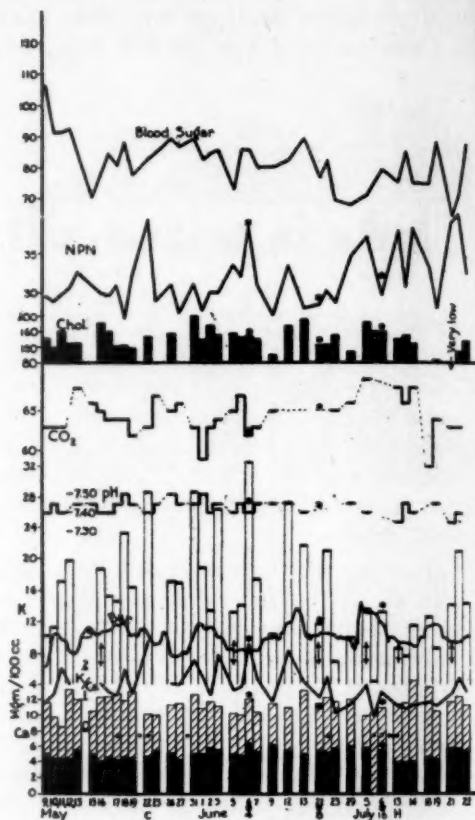


Fig. 12. A case of asthma due to horse hair.
4. 0.1 cc viosterol 10000X daily.
8. 0.25 cc viosterol 10000X daily.
16. 0.5 cc viosterol 10000X daily.

derance of evidence, then, indicates that beneficial effects obtained during one season are not likely to persist into the next season.

While some benefit may be expected from viosterol treatment alone, by far the best results have been obtained in combining this treatment with pollen injections. The mechanism by which this result is obtained is not apparent at present.

To summarize, it appears that viosterol in enormous doses may be administered to human subjects without danger, provided they are carefully observed at all times.

No effort has yet been made to determine whether in human subjects there is any increase in basal metabolism, such as has been observed in normal dogs after the administration of viosterol.

The protection afforded by viosterol against tetany due to parathyroid deficiency seems to be related to the diffusible calcium as determined by the method of ultrafiltration. Human post-operative tetany may be eliminated en-

tirely by careful administration of viosterol of high potency. Whatever changes are induced are of sufficient importance to enable some of these patients to dispense with all forms of therapy after some time.

Viosterol of high potency is beneficial in uncomplicated seasonal hay fever, less so in cases complicated with asthma. In combination with pollen injections still more pronounced results may be obtained.

It is acknowledged that there are many gaps in the information obtained from these experiments and that much more work must be done in order to clarify the many obscurities.

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Discussion

Dr. Victor E. Levine (Omaha, Nebr.): Dr. Reed has stated that more than one gland directly influences calcium metabolism. We are as a rule, inclined to underestimate this statement. Not only can the calcium content of the blood be increased by the administration of parathormone, the parathyroid hormone, but also by extracts from the thymus and from the adrenal glands and from other glands of internal secretion.

He has mentioned the relation of tetany to viosterol or irradiated ergosterol, and he has shown conclusively that irradiated ergosterol or viosterol is very valuable in doing away with tetany, infantile or adult. That brings up a very important therapeutic principle which we can deduct from his work, namely, that viosterol has only one place in medicine, and that is in the treatment of tetany, and that it partakes of the nature of a specific. The indiscriminate use of viosterol in children or in adults for anything and everything has no basis in scientific therapy.

The next point which interests me relates to the fact that calcium determination of the blood does not always foretell the presence or absence of tetany. As Dr. Reed has told us, we can have

tetany with low calcium, or with very high calcium, or even with normal calcium.

Recently McCollum and his associates at Johns Hopkins University have discovered the fact that a low magnesium intake will produce convulsions just as well as a low calcium intake. They have coined the term "magnesium tetany." This tetany may be cured by the administration of a magnesium salt or by a high magnesium diet.

Is it not possible, Dr. Reed, that some of the symptoms of tetany may be due to lack of magnesium or to some other disturbance in the sodium-potassium-calcium-magnesium ratio in the blood? It is now known that patients with neuromuscular instability may have a normal blood calcium but a low blood magnesium. These are cases of essential epilepsy, cases of chorea, and cases of cerebral injury that show a normal blood calcium but a low blood magnesium.

We forget that neuromuscular equilibrium, tremors, convulsions, and other instabilities, are not due to calcium alone, but to a whole aggregate of four or five mineral components, sodium, potassium, calcium and magnesium. If their interrelation is broken, it will produce the syndrome known as tetany. We might say that a large amount of calcium or magnesium would go to the side of stability, whereas a small amount of calcium or magnesium would go toward the side of instability and convulsions. Conversely, an increase in sodium or potassium in the blood would go to the side of instability or convulsions, while a decrease in one or the other of these elements would tend to stability.

We are accustomed to think of sodium bicarbonate as producing convulsions and tetany because of alkalinity. The same result can be produced by administering sodium sulphate or sodium phosphate, or any other sodium salt in large amounts. In other words, an excess of sodium ions may result in convulsions. These convulsions are due to sodium poisoning and not to excess alkalinity.

If we again study irradiated ergosterol from the standpoint of calcium as well as from the standpoint of sodium, magnesium, calcium, and potassium relations, we might be able to work out a reasonable explanation for the variations in calcium which do not fit in with our old conception of the etiological factors in convulsions.

The high basal metabolic rate which Dr. Reed has found in animals subsisting on no food but to whom viosterol was administered is extremely interesting and requires explanation. The parathyroid hormone does not produce a high metabolic rate yet viosterol does. Irradiated ergosterol is not a simple compound. It is a mixture of compounds. The parathyroid hormone is, no doubt, a single compound. The irradiated ergosterol probably consists of several chemical factors, and one of these factors may be of such a nature as to increase the basal metabolic rate.

It may be said this increase in metabolic rate may be an index of the toxicity of viosterol which may not be revealed in the presence of food, some

(Continued on page 89)

ELECTROSURGERY IN CARCINOMA OF THE RECTUM*

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CHICAGO

Much progress has been witnessed in the surgical treatment of carcinoma of the rectum in the last ten years. Under the stimulus of Kolischer, Schmieden, Westhues, Mandl, von Seemen, Goetz, and others, electrosurgery is now more frequently utilized in combating malignancies of the rectum. Operable cases may be favorably influenced by electrosurgery. In advanced conditions, its combination with radium and the x-ray is of decided value. In the hands of the experienced, these measures, alone or in union with radiation therapy, render signal service.

Westhues and Schmieden pointed out the frequency with which rectal polypi become transformed into carcinoma. According to Mandl and Hochenegg 62 per cent of carcinomata of the rectum evolve from polypi in this situation. It is therefore of utmost importance to destroy at the earliest possible moment every polypus discovered. Recently a physician referred his father to me who complained of bleeding from the rectum. A small polypus not larger than the head of a pin was found upon proctoscopic examination. The biopsy report revealed it to consist of malignant tissue. The small tumor was electrocoagulated. In such instances a good prognosis is justifiable. The removal of polypi from the rectum by electrosurgical means is a much safer and more desirable method than by excision with the knife.

Most carcinomas are found at the recto-sigmoid junction; they are found next in frequency in the rectal ampulla, and least in the anal canal.

In rectal operations for carcinoma Mandl and Hochenegg reported a mortality of 11.6 per cent. Of this, 45 per cent were due to pelvic peritonitis, the result of wound and other infections. Cases operated by electrosurgical means show a different picture. This is undoubtedly due to a blocking ef-

fect against the dissemination of microorganisms and other noxae, by sealing of the lymphatics and a sterilization of the field of operation. Freund has shown, as early as 1908, that fulguration will promptly destroy colonies of staphylococcus pyogenes aureus, typhoid and diphtheria bacilli, the bacillus of anthrax and tuberculosis, the Achiorion Schoenleini and other pathogenic microorganisms. Cutting currents have a similar effect. Microorganisms resist certain intensities of heat, due to their location in depths beyond the coagulated areas. Progress of pathogenic germs is effectually blocked by sealing the intercellular spaces, capillaries and lymph vessels by electrocoagulation. The ensuing flow of lymph washes out detritus, microorganisms, etc. Beyond the electrocoagulated area results a zone of hyperemia which swarms with leucocytes and other cellular elements engaged in tissue defensive work.

Advantages of Electrosurgery

As a preliminary step to proposed proctectomy, electrocoagulation of malignant growths in the rectum (von Seemen, Lexer, Kirschner) destroys the accessible neoplasm and effects, to a marked degree, local sterilization. This greatly reduces the chances of infection at subsequent steps of proctectomy.

The dangers incident to the second stage of the operation (dorsal amputation by electrosurgical means) are thus minimized because—

(a) electrosurgery definitely reduces mortality,

(b) local implantations and metastases are prevented,

(c) carcinomatous masses that cannot be removed with the knife can often be attacked with facility by electrosurgical means,

(d) it is the unanimous experience of surgeons operating with the aid of electrosur-

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gery that their patients are surprisingly free from postoperative shock and pain,

(e) the postulate of Mandl, that the extirpation of the lateral chain of lymph nodes including fat, fasciae, etc., harboring malignant cells in a *sine qua non*, can certainly be better complied with by electrosurgical means than with the scalpel.

Malignancies of the rectum, as is well known, are principally adenocarcinomata. Of these 95 per cent are cylindrical celled and 5 per cent represent the squamous cell type. They are known according to their histologic structure as (a) papillary-polypous, (b) scirrhus, (c) colloid, or (d) adenocarcinoma simplex. Sarcomas when occurring, are either melanosarcomata, or of the large spindle-cell variety. The squamous-cell carcinoma metastasizes early into the inguinal lymph nodes. Over 60 per cent of intestinal carcinomas are found in the rectum. These are of slow growth and of only moderate malignancy. Sarcomata are very rare (1:200 according to Clairmont).

Importance of Early Diagnosis

Prompt diagnosis is of prime importance. If the patient suddenly develops hemorrhoids or complains of sciatica, for which no cause can be ascribed, he should be subjected to a thorough examination for the presence of malignancy in the rectum.

Dukes divides carcinoma of the rectum into three groups—A, B, and C—according to the extent of the spread of the disease. In class A are grouped those cases in which the growth is limited to the wall of the rectum. Class B comprises those in which there is already extra-special spread but no lymphatic metastases. Class C embraces that group in which metastases are present in the regional lymph nodes.

There is a striking difference in the operative mortality rate and in the survival period after operation in these three groups. There is reason to believe that in class A cases the disease is completely eradicated by rectal excision, and the excellent results of operative treatment confirm the opinion that lymphatic metastases are not found until the rectal carcinoma has spread by direct continuity to the extra rectal tissues. In cases of class A the prognosis is excellent. A good prognosis is also justified in class B though slightly less favorable than in A.

The result of surgical treatment in types of class C is disappointing.

While carcinoma is a disease of middle and late life, young individuals are not infrequently affected. My youngest patient was a boy of 19, whom I have operated a year and a half ago at the Cook County Hospital for colloid carcinoma of the ampulla of the rectum.

The diagnosis of carcinoma of the rectum can be made accurately in practically all cases if a thorough digital exploration is combined with a careful proctoscopy. Often patients are being treated for hemorrhoids and, sad to relate, many of these individuals supply, as a result of careless examinations, the greatest number of inoperable cases of carcinoma of the rectum.

The physician should pay particular attention to the history of patients who complain of (a) a change in intestinal habits (diarrhea alternating with constipation), (b) bleeding from the rectum, and (c) pain.

Avenues of Dissemination

According to Broders, the prognosis of carcinoma of the rectum depends on the grade of malignancy.

The avenues of dissemination in rectal cancer are by direct extension, or more particularly by transverse. There is a barrier between the lymph space which separates the rectal wall from the *fascia propria* of the rectum. When this space is crossed fixation commences. The lymphatic drainage involved in carcinoma of the rectum above the anal canal has been worked out by Miles, who divided the lymph apparatus into an intramural and extramural group. The former is situated in the wall of the rectum, the latter, more important from the surgical standpoint, is divided into three zones.

Zone 1 of downward spread embraces the perianal skin, ischiorectal fat and external sphincter. Zone 2 or lateral extension includes the lymphatics between the *levator ani* muscle, the pelvic fascia, prostate, base of bladder, cervix, base of broad ligaments and internal iliac lymph apparatus. The third, or upward zone includes the pelvic muscular and lymph apparatus situated at the bifurcation of the left terminal iliac artery and the aortic nodes. This is the most important group.

In view of these anatomico-pathologic conditions, it becomes apparent how important it is in carcinoma of the rectum thoroughly to destroy the structures involved. The cold scalpel, it is obvious, cannot succeed as effectually as can electrosurgery.

Spread through the blood stream with metastases in the liver is a late manifestation. Occasionally it does occur.

Carcinomas left untreated usually prove fatal in from one to two years. There are exceptions to this rule, however. The development of carcinoma is frequently preceded by the development of adenomata. Lockhart-Mummery, and Dukes showed that a carcinoma of the rectum usually passes through three stages:

1. Development of an epithelial hyperplasia (only discovered by the microscope).
2. Appearance of a number of sessile adenomata.
3. Malignant transformation of one of the adenomas. As the disease progresses an annular stricture results. Ulceration occurs late in the disease. Such ulcers have the characteristics of malignant ulcers in general.

There is a divergence of opinion as to the results obtained in carcinoma of the rectum with radiation. However, it has been definitely ascertained that some cases of inoperable rectal malignancies may become operable after irradiation.

Since 75 per cent of recurrences in carcinoma of the rectum spring from the pararectal tissues, it is evident that effectual destruction of malignant cellular elements here can only be successfully achieved by electrosurgical means. The entire surface of the tremendous wound resulting after sacral amputation of the rectum should be electrocoagulated to a depth of 1 to 4 mm. If we recall that 75 per cent of recurrences are due to contiguity and that in the other 25 per cent the dissemination of malignant cells takes place via the lymph and bloodstream, the importance of thorough local destruction of the tissues concerned becomes apparent.

Whether a carcinoma is operable or not is to be decided and evaluated by the experienced judgment and courage of the surgeon. The standard of operability has gradually been widened with the refinement in

surgical technic and the development of greater skill by individual surgeons.

Operability is, for anatomic reasons, higher in women than in men. The situation of the neoplasm is also a factor that determines operability. The size of the tumor is no criterion as an index of probable lymphatic involvement. Fixation considerably influences operability. Preliminary electrocoagulation and an anus preternaturalis will frequently cause apparent fixation to recede and render the picture more hopeful.

Types of Operations

What operation suits a given case best? Dogmatization is dangerous. The surgeon should have at his command a number of procedures suitable to a given case.

Abdomino-perineal resection or amputation in one stage will show a rather high operative mortality (20-40 per cent in the best hands).

Recent statistics eloquently speak for attacking rectal malignancies by the combined abdomino-sacral route. Mandl's report of 984 sacral operations shows a mortality of 11.6 per cent. In 30 per cent of 700 of these cases the end results were good after 5 years. This markedly contrasts with the operative mortality of the one stage abdomino-perineal operation.

In my last consecutive dozen abdomino-dorsal amputations of the rectum for carcinoma by electrosurgical means, my mortality was *nil*.

The accepted treatment of carcinoma of the rectum by most surgeons is standardized into the following well-defined procedures:

1. *Resection* of the affected section of the bowel with removal of the retrorectal and pararectal tissues. Union of bowel ends with retention of sphincters. This is preceded by electrocoagulation of the mass in the rectum through a speculum. In electrocoagulation of malignant masses in the rectum, one must proceed slowly lest perforation of the rectal wall occur.

2. *Amputation of the rectum.* (a) Colostomy (permanent). (b) Preliminary destruction of the tumor mass through the rectum followed by (c) Amputation — dorsal or perineal.

3. Borderline cases and inoperable carcinomata of the rectum. A great deal may

be accomplished here as well as in far advanced cases by approaching the tumor through a posterior proctotomy (Kraske). The accessible carcinomatous mass is destroyed by electrocoagulation.

Radium may be used in conjunction with electrosurgery in some of these procedures. The span of life and comfort of the patient in many inoperable cases is definitely lengthened. In fact, it is the only method that offers at least temporary relief and possibility of prolongation of life.

The farther the carcinomatous mass has encroached upon the peritoneum, the worse the prognosis. In this connection it may be of interest to mention the method of Newmann and Coryn who proceed in inoperable carcinomata of the rectum as follows:

They first create an artificial anus; the rectum is then exposed after first removing the coccyx. Radium needles are then introduced in every direction and in places where dissemination of carcinomatous tissue is suspected. At a second stage, amputation of the rectum is performed.

In the cases of debilitated and old individuals who have no physical stamina to withstand a radical operation and where the malignant involvement is marked, a *laissez faire, laissez mourir* (leave alone, let die) attitude is to be deprecated. Here electrosurgery may play an important rôle if properly used. It will not cure, but will palliate and prolong life.

The advances made with electrosurgery in the treatment of malignancies of the rectum is in step with the progress made in the treatment of tumors of the face and brain.

The absence of shock, the sterilizing action of the high frequency current, the lowered mortality and morbidity, place electrosurgery far ahead in the fight on cancer in these situations.

It is imperative that all pararectal tissues be removed in carcinoma of the rectum. The bowel should be amputated at a high level. A thorough removal of the lymph nodes around the superior hemorrhoidal artery is of equal importance. Between 15 and 30 cm. of the bowel above the lesion should be taken away depending upon existing conditions.

While many authorities are partial to the

abdomino-perineal route in extirpating malignancies of the rectum, those conversant with good technic in electrosurgical procedures can get better results by well planned abdomino-sacral procedures.

While doing a preliminary colostomy one should examine the liver, the peritoneum, the chain of lymph nodes along the aorta and down in the pelvis to discover the presence or absence of gross metastases. One can, of course, never be sure of the presence or absence of implantations of microscopic dimensions.

Operative Procedure

Before attempting proctectomy a mastery of the anatomy of the parts is essential. I have adopted the following plan of operation:

First stage. Permanent colostomy. Mixer type.

Second stage. Preliminary destruction of carcinomatous mass through speculum by electrocoagulation.

Third stage. Sacral proctectomy. Spinal anaesthesia, (Tropacocaine,^a neocaine or procaine). Patient in inverted Trendelenburg position. Hips high, head and legs lowered. Separate thighs. Tie catheter in bladder. Close anus with purse string suture.

Incision with high frequency scalpel encircling anus and extending over coccyx and sacrum. Removal of coccyx and last two sacral vertebrae. Hemostasis of *sacra media*. Separate bluntly rectum from its posterior attachments as high as the promontory of the sacrum. Divide strands of connective tissue and fat lateral and above tumor with high frequency scalpel. Bleeding here is controlled by electrocoagulation. Divide the *levator ani* from above and as lateral to the sides of the pelvis as possible.

Incise *fascia propria* transversely and continue along side of bowel. Seek cleavage space (zone décollable of the French) between rectum and prostate or vagina. Separate rectum from prostate or vagina by blunt dissection. Divide tissues supporting the lower portion of the rectum, (sphincters, perineal muscles, etc.). Enter hollow of sacrum through transverse incision made in *fascia propria*. Divide lateral bands in hollow of sacrum coursing toward rectum and carrying the middle hemorrhoidal arteries. Hold back mobilized bowel toward

sacrum. Open peritoneum. Avoid ureters. Palpate, isolate and ligate superior hemorrhoidal vessels. Remove nodes and the fat about it. The vessels should be divided as high as possible near the promontory of the sacrum. Resuture peritoneum to bowel above point of proposed division. Divide bowel above with same scalpel between two right angle clamps. Close proximal end. Suture peritoneum over it. Electrocoagulate all exposed suspicious surfaces in pelvic wound to a depth between 1 to 4 mm. All maneuvers with the exception of ligating superior hemorrhoidal and perhaps the middle hemorrhoidal vessels are carried out with electrosurgical knife. The rest are cared for by electrocoagulation. Mikulicz drain.

The indwelling catheter remains as long as it seems feasible. General postoperative care is of utmost importance. The postoperative course in cases thus operated is surprisingly uneventful. The patient feels well. He does not experience the usual effects of shock as is the case in operations with the scalpel.

In inoperable carcinomas, particularly of the anterior wall of the rectum and in recurrences, even when they have transgressed onto the peritoneum, patients may still be benefited by attacking the malignant masses by electrosurgical means. Hopelessness and despair often gives way to relative comfort in a certain number of cases for many years.

Conclusions

1. Early diagnosis is essential in carcinoma of the rectum, if mortality is to be reduced.
2. Electrosurgical removal of the involved bowel segment offers many advantages over the time honored scalpel dissection.
3. A series of fourteen successive cases of rectal carcinoma, removed by electrosurgical means without a death, are reported.
4. The advantages of graded operations are stressed.
5. So-called "inoperable" cases of carcinoma of the rectal ampulla may be much benefited by electrosurgical means.

THE USE OF SURGICAL DIATHERMY IN RELIEF OF CASES OF INOPERABLE CARCINOMA *

RALPH BOERNE BETTMAN, M.D.

CHICAGO

This report deals with a series of clinical events which I, and my associates, call the Kolisher Phenomenon. I intend to describe these events as I have seen them giving you simply the clinical pictures and omitting all theorization as to the cause thereof. This paper deals solely with a method of treatment which seems to give relief, temporarily only it is true, in certain types of that large group of hopeless, pain racked patients suffering with inoperable carcinoma.

Several years ago Kolischer, who was one of the leaders in changing our conception of carcinoma from that of a local disease to that of a general condition, suggested to me that it might be worthwhile trying to

stimulate the reactive powers of the body by cauterizing a portion of the malignant mass. At that time I had in the hospital a thirty year old girl who had been operated upon some six months previously for a carcinoma of the breast. The lesion had been excised by an incompetent operator, not a surgeon, and then when the diagnosis was established by microscopic examination, the radical amputation had been performed some five or six days later. I must emphasize that this procedure of delay invariably leads to recurrence and cannot be too strongly condemned. In this case, too, the lesion had promptly recurred so that at the time I am referring to, there was a nasty foul smelling growth involving the mastectomy scar. There were numerous palpable metastasis in the neck. The patient

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was extremely cachectic and completely bed ridden. Her home was in Iowa and her one wish was to die there. It seemed an ideal case to try out Dr. Kolisher's suggestion.

Under nitrous oxide and oxygen anaesthesia, I coagulated the foul smelling recurrence. There was practically no *immediate* general reaction but within a few days the girl commenced to improve. She looked better and felt better and in about two weeks left the hospital for her home in Iowa. The improvement continued and for about three months she lead a comfortable, happy existence. At the end of this time she again became worse, the mass at the site of operation increased in size, started ulcerating and the cachexia was soon full blown, and she again came to Michael Reese Hospital to seek relief.

We were able to repeat this series of clinical events twice more before she died, the improvement being a little less striking and of shorter duration each time.

Since then we have seen several other patients with recurrent ulcerating carcinoma of the breast. In spite of metastasis elsewhere we have been able to bring about temporary improvement by means of surgical diathermy, an improvement which appears to be greater than could be explained solely because of the removal of the ulcerating mass.

Cancer of Rectum

Another type of case which has lent itself especially to surgical diathermy has been carcinoma of the rectum. In no other group have the results been as striking. The technic is so simple that a surgeon must think very seriously before recommending any other procedure if there is a question of inoperability. Our first case in fact almost lead us to believe that we might expect a cure.

The patient was a man in his early forties, who had come to me because of "hemorrhoids." The usual preoperative proctoscopic examination revealed a bleeding cauliflower mass in the rectum close to the anus. I advised a typical two stage removal, but the patient absolutely refused such an operation. He had had a relative who suffered from a poorly functioning colostomy and would have none of it. He begged me just to stop the bleeding so that he could carry on a little longer and would then be willing to let nature take its course. He was in very poor

health which he attributed solely to the loss of blood.

I coagulated the mass. There was practically no immediate reaction to the operation, none as much as one sees after the average surgical operation. We expect that now, but in the early days of surgical diathermy it was a source of surprise to us to see how well even the most cachectic individual would stand what *a priori* might be supposed to be a very shock producing procedure.

The patient improved rapidly and within a few weeks was back at work. I lost track of him after a year. At that time he claimed he was cured and would not permit me to examine his rectum. In all probabilities of course the carcinoma returned and he is long since dead. Since then I have coagulated by means of diathermy a series of cancer of the rectum. These were all either relatively inoperable, obviously inoperable, or in very old people. In very old people, I feel that I am justified in advising coagulation instead of surgical excision even in operable cases, because of the simplicity of the procedure. The course of events in these patients with inoperable carcinoma of the rectum, after diathermy, is very much the same. Immediate reaction to the procedure is so light as to be surprising. The improvement sets in rapidly and often is so marked as to make the patient and his family think that a cure has been accomplished. The duration of improvement naturally varies according to the condition. Let me cite to you a typical case which will describe the sequence of events very well.

Three years ago I saw an old gentleman, in the seventies, who had been sick for almost a year. He had what had been thought to have been "bleeding piles." He was now suffering from pain in the pelvis, abdominal cramps, and general debility. He had a large ulcerating mass in the rectum which was producing a partial obstruction. His abdomen was distended and tympanitic. There was no question that the cancer had invaded the neighboring structures and that the case was inoperable. By means of the high frequency knife and surgical diathermy, I was able to enlarge the obstructed intestinal channel and coagulate most of the mass. No colostomy was performed. It will surprise you how frequently you will be able to avoid a colostomy. Following the extensive coagulation there was practically no reaction. The old gentleman had to be catheterized once, but inasmuch as difficulty in urination had been one of his chief complaints, this was expected. He had some "gas

pains" which were relieved by passing a rectal tube. After the first week he started feeling better, the pelvic pain diminished and the abdominal cramps entirely disappeared. His difficulty in urinating ceased, he felt stronger and left at the end of the tenth day feeling much better than when he came in. The improvement continued so that after a month he declared himself cured. He stayed apparently well for six months and then very quickly the obstruction and all other symptoms returned. At this time the mass in the rectum was much smaller than on his first admission and not as firmly fixed. The second improvement lasted also for almost six months, and a third for three months. At the end of the third he developed an acute intestinal obstruction. A colostomy was performed but he died a week or so later without rallying.

We feel that we rendered a great service to this patient, that in the avoidance of a colostomy we spared him much mental and physical anguish. From a theoretical point of view, a colostomy is indicated and in younger individuals we often recommend it. However, a colostomy is not a necessary procedure for relief of pain or bleeding. The presence of stool in the rectum does not seem to irritate the coagulated mass. I have not had a single severe hemorrhage.

A word or two in explanation. It is absolutely true that in these cases I have dis-

cussed, there were many other factors which might and undoubtedly did contribute to the gratifying results besides the reaction to the diathermy. The removal of an infected mass, the relief of a partial intestinal obstruction, as in the rectal cases, would alone have made the patient feel better, but we are sure that that alone will not account for the improvement.

As to the cause for the improvement in the condition of the patient I can say nothing further than what Dr. Kolisher said originally; namely, that it is due to a stimulation of the body defense mechanism. This is naturally a vague rationalization rather than an explanation but seems to be about as far as we can go. From the immediate practical point of view it is of the greatest importance to us to realize that by means of the partial destruction of a malignant growth by surgical diathermy we can cause a very marked, if only temporary, improvement in the patient's condition, and that this improvement is much greater than would result from the simple removal of the same amount of tissue with a scalpel.

104 South Michigan Avenue.

SURGICAL DIATHERMY OF CARCINOMA OF THE RECTUM:

Further Observations and End Results *

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CHICAGO

One year ago we reported before this society our experiences regarding a series of cases of carcinoma of the large bowel and especially those of the rectum, giving some of our impressions and interpretations of these results. We pointed out, as Kolisher did in 1910, that the coagulation effect by diathermy not only produces a mechanical

destruction, but that certain substances and antibodies are thrown off into circulation which tend to immunize the patient against further progress of the disease and apparently arrest the growth of carcinomatous tissue and cells remote from the point of destruction. It seems quite possible from histological examination that some of these carcinoma cells are rendered inactive as far as tumor growth is concerned. This may be attributed to an intense stimulation of the reticulo-endothelium system and its consequent local and general phagocytic action of the macrophages. We are still in the midst of investigating this problem by animal experimentation. These end prod-

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ucts are in all probability similar to those produced by x-ray or radium.

We also called attention that repeated blood transfusions from young individuals, especially from those who have an absence of history of carcinoma in their family, may have an immunizing or carcinolytic effect on patients suffering from carcinoma. At that time we also laid a great deal of stress on the technic and preparation of these patients for surgical diathermy, suggestions which have been incorporated in our previous report.⁽¹⁾

Our end results and observations during the last year have not only resembled our previous experience, but have strengthened our impression that this method of treating carcinoma of the rectum is an excellent one and warrants its further use and investigation.

Analysis of Additional Data

We therefore present additional data based on an analysis of 21 cases, most of which have been observed from two to three years, and a few from five to six years. Of the 21 cases, 16 of them up to the present time may be considered as having attained good results. One case of multiple carcinoma of the colon has metastasis, and was first operated for carcinoma of the splenic flexure in 1931. Three patients, two of whom were 70 years of age, died of bronchopneumonia. All three of these patients had inoperable carcinoma of the rectum involving the prostate and died from three to four months after surgical diathermy, probably due to their debilitated condition. One died of late secondary sepsis with probable metastasis and urinary infection nine months after electrosurgical intervention. One patient died from metastasis who, in 1930, had a three stage Mikulicz operation for carcinoma of the sigmoid, which also involved the ileum, necessitating the extra resection of a loop of ileum with that of the sigmoid. One year later this patient developed carcinoma of the rectum, at which time surgical diathermy was performed. He undoubtedly died of abdominal metastasis eight months after this operation, which probably extended from the original carcinoma of the sigmoid and ileum to its mesenteries.

In analyzing these five deaths, only two can be laid to poor results from diathermy. One was a patient who had secondary infection and metastasis, the other a very debilitated

70 year old patient who died from pneumonia ten days after electrosurgery. The other three patients, in whom pneumonia occurred three to four months after operation and the one who died from metastasis for carcinoma of the sigmoid, and for which a surgical procedure was performed, are hardly fair subjects to charge to this procedure.

Of the 16 cases in which we have obtained good results, we can state the following facts: On rectal examination, nothing but scar tissue can be found, and on examination of the scrapings, no carcinoma can be found. The scar varies in different individuals, some have soft scars and others have quite marked scars which are rather firm, but all are easily dilated. The amount of scar tissue seems to vary in these patients and seems to be due to the different reaction in the various individuals. All but two have gained in weight. All have apparently lost their cachectic appearance and seem to be in good health. No metastasis can be found in these individuals. We have brought here three of this group for examination by anyone who wishes to verify our contention of what we consider a good result.

In two cases, one of six years duration and one of one and one-half years standing, we have excised the scar by modified Kraske, simply excising the coccyx and then excising the scar, trying to preserve the muscles and making an end to end anastomosis. In the individual of six years standing, the excised tissue shows absolutely no carcinoma on gross or histological examination. This patient is in excellent health and seems at least locally quite free from the disease. For the other patient who had a surgical diathermy one and one-half years ago, we excised the scar by a modified Kraske seven months ago. The histological section shows remaining carcinomatous cells which, however, appear inactive since on gross examination no carcinomatous tissue seems apparent and the carcinomatous cells do not show any active mitoses. This corresponds to the rectal examination in which no hard carcinomatous tissue can be felt. The point of operation is so smooth in the rectum that on rectal examination one can hardly ascertain where the anastomosis has been made. I think it is only fair to assume that these carcinomatous cells were rendered inactive by surgical diathermy.

In view of past experiences, anyone who

has done Kraske operations for carcinoma of the rectum knows that when active carcinomatous tissue is present at the point of anastomosis, nodules of carcinomatous tissue will appear along the line of anastomosis. We therefore feel that this is a convincing demonstration that surgical diathermy in some way renders the carcinomatous cells inactive from further function or reproduction. This could be due, first, by rendering the cell itself inactive, or by the great amount of connective tissue that seems to be thrown around these cells. Probably both are factors in the end results attained.

Complications

Some of the complications that we would like to call to your attention are as follows: Four cases had severe hemorrhages which usually came on between the 6th and 12th day. These hemorrhages, however, were always easily controlled by packing the rectum, using a small amount of adrenalin with the packing. In one a vessel was ligated and two needed a blood transfusion. We would therefore urge that for the first 12 to 15 days these patients be definitely held in the hospital and carefully watched for bleeding. There can be no question that when these sloughs come on, a good sized vessel may be opened, but all bleeding can be controlled since the area involved is easily packed off.

All the patients ran a temperature varying from five to twenty-one days. This reaction, of course, varies first with the extent of the amount of coagulation and extent of carcinoma which has to be coagulated. We have always attempted to destroy all of the tumor at one time, except when the prostate was involved. One had a complete slough of the lower portion of the rectum, and this patient, of course, is in the same condition as one that had a radical Kraske performed, but is in excellent health now. Two of the male patients developed marked urinary spasms, but no one had blood in the urine or perforation of the bladder. It is quite evident to us now that the procedure in women is much more favorable than in men on account of the relationship of the bladder to the rectum. It is also quite evident that those carcinomas of the rectum in men which lie just above the prostate near the seminal vesicles, are not as favorable for surgical diathermy, or at least

are more apt to have urinary symptoms than those which are located near the anus.

Fifteen of these cases had preliminary colostomies, one an ileostomy, and five had no preliminary colostomies or ileostomies. Fourteen had one diathermy, five had two, and two had three such operations. Those who had a second or third electrocoagulation had what appeared on examination to be some remaining or recurrent carcinomatous tissue.

Technic

As to technic, at first we used a very high voltage with a fair spark gap, later we changed to a low voltage and a wide spark gap, the idea being that the low voltage would give deeper penetration than the higher voltage. We are not convinced that this deep penetration is correct for diathermy of the rectum, and we therefore have returned to the high voltage and medium spark gap. We believe that the low voltage, which produces too deep a penetration, provokes much scar tissue and destroys too much of the surrounding tissue. The high voltage current which penetrates to a lesser degree destroys all the carcinoma of the rectum and not the surrounding tissue, and does not produce as much scar tissue. We, therefore, for the present recommend the high voltage and the medium spark gap.

The other factor that we would like to call to your attention is the difficulty in controlling the amount of surgical diathermy to be used and, after all, that is a question of judgment. It is advisable from time to time to determine the extent of local temperature by inserting one's finger in the diathermized area and to judge thus the amount of heat felt in there, and when too hot, cool it off with ice cones.

Conclusions

It is quite evident from the above data that not all the cases react alike. The majority seem to be relieved of the local carcinoma and to obtain what appears to be excellent clinical results. Others have not reacted well and showed definite recurrences in spite of repeated diathermy treatments. Whether this is due to a difference in the reaction of the zone of coagulation or to the thoroughness of the coagulation is difficult to tell. We feel, however, that the clinical end results of our present series of 21 cases, in which six of them were practically inoperable cases, com-

pare most favorably with the best surgical results obtained. This is especially significant since the good results obtained were done without a preliminary colostomy or ileostomy, which of course means a good deal to the patient, since it means that they have good control of the rectum. This report however does not intend to convey the impression that we have a cure for cancer of the rectum, but simply that our results warrant the continuance and further investigation of this treatment.

104 S. Mich. Ave.

Reference

1. Strauss, A.: Surgical Diathermy of Carcinoma of the Rectum and Its Clinical End Results. *Arch. Phy. Ther., X-Ray, Rad.*, 14:212, (April) 1933.

Discussion

On Papers of Drs. Blech, Thorek, Bettman and Strauss

Dr. Leon Bloch (Chicago): Since the majority of the patients with carcinoma of the rectum have been so afflicted anywhere from a few months to more than a year before they come to the doctor, it is readily conceivable that the symptoms will vary considerably and many patients will have inoperable carcinomas when they come for examination. The mild symptoms are rectal distress and the desire to have a bowel movement with ineffectual results. The passage of slight amounts of mucus and small amounts of blood are frequently overlooked or laid at the door of constipation, for which the patient plies himself with cathartics. Only when large quantities of blood are passed or the pain becomes severe does the patient seek relief.

Unfortunately, in many of these patients the diagnosis of hemorrhoids is made and in not a few it is really the fault of the physician who fails to make a rectal examination. Severe pain and loss of weight frequently indicate inoperability rather than operability, because they are symptoms of an advanced lesion. The majority of the cases of rectal carcinoma can be diagnosed in two ways, by digital examination because the carcinoma is within reach of the fingers in 90 per cent of the cases, and by proctoscopy. Frequently when the proctoscope is inserted the carcinoma may not be visible because the instrument slides over the lesion, but on its withdrawal one will be able to see the carcinoma very easily because the rectum is distended at this time. I do not believe that a biopsy is absolutely necessary for the diagnosis of carcinoma of the rectum.

A benign lesion or a plaque may precede the malignant stage. These are the lesions that I believe should be removed by diathermy, because the procedure is much less extensive and does not involve the removal of a large amount of tissue. In the inoperable cases where the carcinoma is large and where the lesion has

existed for a long period and has encroached beyond the lumen of the bowel, I believe there is a definite field for diathermy, for two reasons, first, the inoperability and the extent of the lesion which renders surgical intervention difficult, and, second, because destruction of the lesion by diathermy at times may render the condition easier for subsequent surgical operation.

When one compares the statistics of classical surgery of electrosurgery one is struck by the fact that the immediate mortality in both is practically alike. Mummery states that his immediate postoperative mortality is not over 2 per cent. He may be a little critical in the selection of his cases, but 2 per cent is a very low mortality. Rankin, in the Mayo Clinic proceedings, states that his mortality is around 10 per cent, and Mandl and Hochenegg, quoted by Dr. Thorek, about 11.6 per cent. The mortality rate from diathermy is practically the same.

There are insufficient statistics available over a long enough period of time to determine whether surgical diathermy will ultimately be of as much value as classical surgery. However, when we contrast the extent of the operation, the possibility of shock and the prolonged convalescence with the mortality of 10 per cent on the one hand, with the pain, the urinary distress, the intense strangury, the frequency of the development of strictures, which necessitate frequent dilatations and oftentimes subsequent excision of the stricture, on the other hand I wonder whether if I required an operation I would prefer surgical diathermy to surgical removal. The abdomino-perineal type of operation in expert hands is after all not such a formidable operation. It is not known how much destruction diathermy is going to produce nor is it known just how harmless diathermy will render the regional invasion around the rectum. It is known that the distal glands are not removed by diathermy and that recurrences are not infrequent. Carcinoma rests are found after operation and may ultimately disappear; but they do not always disappear. Mummery reports that 47 per cent of his patients were free from carcinoma five years after operation. I think that while we must give considerable praise to those who are doing work in diathermy, to Dr. Thorek who has done 12 successive cases without a fatality, and to Dr. Strauss, one must hold in abeyance any decision as to which procedure is preferable until a sufficient time has elapsed before recurrences and disability requiring secondary operations are sufficiently few to warrant the continuance of diathermy as a surgical measure.

Dr. Gustav Kolischer (Chicago): As I see it, Dr. Thorek and Dr. Strauss take different views of the whole situation so far as electrosurgery in cancer of the rectum is concerned. Dr. Thorek employs rectal surgery simply as a substitute for the scalpel in the so-called operable cases. Dr. Strauss takes a different attitude. He uses electrosurgery as a means of destruction and not as a means for excision or resection.

I should like to analyze a little the traditional attitude of surgeons to operations of the rectum. Starting out from the theoretical viewpoint we always hear about the great advantages of extensive operations, removal of the glands, and so on. Is there any surgeon who really believes that when he removes so many glands he removes all the lymphatic tissue that is infected by cancer cells? Nobody could possibly believe it. I should like to draw attention to a parallel experience. It will be remembered that some years ago when the Ries operation was introduced for dealing with all kinds of cancers of the uterus, our hopes were based on the extensive removal of apparently healthy tissue, and search for and removal of palpable glands. What was the lesson learned? One of the foremost gynecologists of international reputation, Clark of Philadelphia, adopted the operation with great enthusiasm but later abandoned it because the disadvantages of this operation outweighed any possible benefit. In several European clinics where parallel studies were made of both the massive abdominal operation and the simple hysterectomy, without removal of the glands, the results of the latter operation were far superior. The same thing probably holds true of the rectum.

As I mentioned before, Dr. Strauss takes the position that he coagulates as a means of removing the tumor. He takes advantage of one fact that is not sufficiently appreciated by most surgeons. We know, and can prove it, that in many instances partial destruction of a tumor by coagulation may lead to a final and a definite result. We recall four cases of cancer of the bladder which we had coagulated by diathermy; after a certain length of time there sprung up a few papillomas. These were entirely benign, as proven not only by cystoscopy but by biopsy. The patients remained well and the papillomas did not recur, so they must have been benign.

All these fantasies about the extensive operation for removing cancer, removing the glands, and so on, suffer from one absolutely logical fallacy, and it is this: If we are not in a position, and in most cases we are not, to remove the entire cancerous tissue, we are certainly not dealing with the underlying factors that produce cancer, and there is always this deficiency in any cutting operation. Other logical fallacies restrict electrocoagulation to inoperable cases. There is a certain human equation that enters into it. No surgeon, who, after years of hard work and of experience, has built up a technic likes to dispense with it. He rather likes to stick to his technic and to his convictions. If I have a method which in a number of instances and in so-called inoperable cases furnishes results, why not apply the same method to the operable cases? That is simply following tradition, and traditions in medicine are the greatest obstacles to progress.

In reviewing my experiences, I remember the time when the carcinoma operation was being developed. I saw a great many done, and I did a few when I was in general surgery. I do not

hesitate to say that I expect that electrocoagulation will supplant resections or excision by the knife or by the cutting current, as I am sure that electrocoagulation combined with proper therapy will supplant hysterectomies. It does not make any difference how we cure the patients if we cure them, and otherwise have a low mortality. Notwithstanding all the arguments that are constructed, they are not borne out by our knowledge, by our findings, and by sound reasoning.

Dr. R. W. McNealy (Chicago): I am in hearty accord with the statements made by Dr. Kolischer. His remarks about the extension of carcinoma represent the very crux of the situation. Carcinoma begins as a chronic local regenerative process in individuals who have a varying degree of general susceptibility. The recent statistics of carcinoma of the breast show that more than 70 per cent of the cases, which are submitted to operation, have either local or general metastases. These same statistics also show that more than 90 per cent of these operated patients ultimately die of carcinoma. At present, we have no means of combating the general susceptibility to carcinoma and our efforts must be confined to the eradication of the primary lesion and the prevention of the local recurrences. When the lesion is local and confined to the organ in which it originates, there is no necessity for radical excision. When the carcinoma has metastasized, it has probably passed beyond the regional lymphatics even before they have been plugged and enlarged by the carcinoma cells which have lodged in them. There is nothing that we can do about the cells that find their way into the general circulation through the thoracic duct; neither can we estimate the ability of the body to take care of these cells. We must make use of every means at our disposal to eradicate the primary lesion and prevent local recurrence.

I was rather disconcerted to hear Dr. Bloch say that the discussion had been divided into that of surgeons and that of diathermists. Perhaps, I misquote him. We should not be proponents of any method but should be scientific men, who are using any and every method which will alleviate the suffering of patients. Diathermy has a distinct place in the treatment of carcinoma of the rectum. Its use should not be confined to those cases wherein only palliative measure are indicated. Decompression drainage of the colon is an important part in the treatment of carcinoma of the rectum. It does not matter whether this decompression drainage is accomplished by a preliminary colostomy or whether it is secured by coring out the carcinoma stricture with the diathermy. In either case, the system is relieved of the stagnant, putrid cesspool which exists proximal to the stricture. When diathermy is used to secure this drainage, it also clears away a considerable quantity of sloughing, infected tissue from which considerable absorption must take place. The general reaction following local diathermy application is not easily explained. Dr.

Kolischer has emphasized the importance of this reaction.

Dr. Thorek should not be too elated over his success in removing the small polyp, which, on section, proved to be malignant. Sampson Handley has directed our attention to the fact that there is a possibility that these malignant polypi and papillomata result from stagnation of the lymphatic system which drains the areas in which they occur. Polypi do not degenerate into carcinoma but polypi develop on carcinomatous bases. If this is true, then it is far more important to excise the base of the lesion than it is to merely remove the polypus. Diathermy is an excellent method of eradicating these polypi and destroying their bases.

The most depressing thing to me is the large number of cases which present themselves with very extensive lesions and give a history of symptoms being present for months before advice is sought. I do not believe that it is poor diagnostic ability that accounts for the low percentage of operability of these cases. If they are not seen by medical men until they are inoperable, then the problem is not a medical one alone, but it should direct our attention to the need of public education along this line.

Dr. Wm. B. Eicher (Peoria, Ill.): This has been a most interesting and comprehensive presentation. Dr. Thorek has made important observations. The most notable, I think, is the frequent occurrence of rectal malignancy, and that it often comes from polypi. So it is necessary to find them early. The next important lesson is the favorable results obtained in the treatment of rectal growths generally, with electrocoagulation. The power to go beyond the reach of ordinary surgery alone, in killing microorganisms; the sealing effect on the lymphatics, and the sterilizing value on the field of operation and the surrounding tissues are well brought out in the paper, clearly, concisely, and logically. Excision alone, too frequently falls short of ultimate success.

Dr. Ulrich D. Rumbaugh (Kingston, Pa.): It is gratifying to hear the surgeon proclaim the advantages of electrosurgery in dealing with carcinoma. Dr. William Clark has given substantial reasons for these advantages. (Electrotherapy and Light Therapy, Richard Kovacs, M.D., Page 272.) Carcinoma is the most frequent tumor of the rectum. It occurs at the (1) anus (squamous cell)—very rare; (2) just above the sphincters (adeno-carcinoma, often encephaloid); or (3) above the reach of the examining finger in the upper rectum or pelvic colon, at the level of the promontory of the sacrum (adeno-carcinoma, often scirrhus). In the latter situation about two-thirds of the rectal carcinoma are found. The rectum is frequently invaded by carcinoma originating elsewhere (prostate or cervix uteri).

Anal carcinoma causes secondary invasion of the inguinal lymphatics, and clinically resembles epithelioma of the lower lip. True rectal carcinoma extends in the subcutaneous tissue of the

rectal wall rather than directly through it to neighboring structures.

The defensive process set up against bacterial invasion and infection following electrocoagulation is a very important factor in the ultimate healing of the electrocoagulated area. Electrocoagulation seals blood vessels and lymph channels of the periphery of the coagulated lesion. Hemorrhage is under complete control or can be prevented; it destroys bacteria in the field of operation and the heat produced causes the destruction of any malignant cells concealed in contiguous tissues.

The first important step in the treatment of carcinoma of the rectum—and the one that tests the skill and judgment of the surgeon, is the determination whether the lesion is operable or not. As has been well said, this decision must be influenced by the position of the lesion, the duration and whether or not it is fixed. I agree with Dr. Thorek that very often radiation will render an inoperable carcinoma an operable one. X-ray or radium will very often be a valuable adjunct to electrocoagulation wherever there may be any doubt about the complete destruction of malignant cells in adjacent tissues.

Dr. William E. Ground (Superior, Wis.): We have heard the virtues of electrosurgery extolled in the medium cases and in the extreme cases, in the inoperable cases, but I want to emphasize its benefit on the earlier lesions. Twenty per cent of the cases of cancer get to the surgeon in time to do them any good. It is the 80 per cent that I am worrying about. If this 20 per cent get into the hands of electrosurgeons like Dr. Thorek or Dr. Kolischer, they stand good chances of getting a marked benefit, but if they have to submit to the old cold steel process of surgery they have my sympathy. I haven't put a knife into a malignant disease for ten years or more.

When I first began to use diathermy methods for excising cancer I ran everybody out of the operating room, and then when electrosurgery came into vogue, largely stimulated by Dr. Kolischer's work, I adopted it. We have consistently used some form of electrosurgery ever since, in all types of malignancies. It possesses great advantages, there is no question about it. I get so emphatic about it that I almost feel like saying that cutting surgery has no place at all. We should study cancer in the initial lesions. We should know the nature of the cancer, the location of the cancer, the certain ages at which cancer occurs, and the locality.

As we are talking about the rectum particularly, I want to emphasize the laxity of many men in examining the rectum. This last summer I ran across three or four cases of cancer of the rectum that had never been examined, and one case had been examined and injected for piles. These patients had all kinds of symptoms. They bled and a prescription for suppository was given and no examination made.

Dr. McNealy spoke of polypi. I have been quite a close student of Dr. Sampson Handley's

work, and there is much in his work and in the work of others to teach us the early signs of cancer. Papilloma is a potential malignant lesion. It doesn't make any difference where you find it, in the bladder, or the kidney, it is a step toward cancer. It may not be cancer but it has the makings of cancer. They should be destroyed, and they can be destroyed in no other way half as safely and as simply and as surely as by electrosurgery. All papillomas, it doesn't make any difference how they appear, should be destroyed by electrosurgery.

With regard to papillomas, I have recently seen an article by Mumemry in which he mentions the peculiarities of papillomas. He says that you may have multiple polypi in the colon, for instance, and one of the polypi down around the rectum will develop into cancer and the others will disappear.

With regard to polypi of the bowel, I have a case in mind, a man who had digestive symptoms and one doctor after another in our town saw him. He went to Rochester and he was x-rayed and nothing found. Dr. Bell opened the abdomen and the stomach and he found a cancer of the stomach on the posterior wall, and he said that the case was inoperable. He felt down into the bowel and he found several polypi. Other polypi were in the stomach and in the intestines. The abdomen was closed, and the patient came back to Superior, and he happened to fall into my hands. This man goes along for several months and develops jaundice and some other symptoms. Finally a post mortem examination was made, and there was some suggestion of cancer of the stomach, but all the polypi in the stomach and in the intestines had disappeared. The pathologist who made the report said that the man had died from myelogenous leukemia. His liver was large and he had jaundice, but there was no carcinoma in the liver. It may be that has some bearing on the possibility of cancer not being a purely local disease.

This cancer question is a momentous one, and I never like to pass up an opportunity to urge that the laboratory is not the only place where it should be studied. We ought to get the general practitioner to study his cancer cases. In Wisconsin we have a law that all cases of cancer must be reported. We are getting up quite an elaborate report so as to get every practitioner to report his cases and see if we perhaps can't learn something about cancer that the laboratory does not teach us.

Dr. William Schmidt (Philadelphia): I think that one of the most encouraging features about this whole program has been the fact that these methods are being employed by experienced surgeons. I think that is the proper place for methods of this type. This is not work for the average man doing physical therapy. It is work for the experienced surgeon.

I do not think it amiss to again emphasize the fact that so many patients complaining of rectal conditions are not examined when they

consult a physician. It is such a simple and easy thing to make a rectal examination with the finger or even with the proctoscope that it seems a shame that so many of these patients are allowed to go on to the stage where they are inoperable, or where the condition has spread, before anything is done for them. That is one thing that we certainly should preach to all general practitioners and even surgeons, too, have been known to neglect it.

A point in connection with this is that in these cases where the scars had been examined following the destruction of the growth by electrothermic methods carcinoma cells were found. One of the principal things that carcinomas demand is a blood supply, and you will notice that in these sections that were shown the blood supply was very markedly diminished. There is a large amount of scar tissue surrounding these cells and as long as that remains that way there is very little likelihood of these cells beginning to multiply. I think that is one reason why recurrences are not so likely to follow the use of electrothermic methods.

Dr. Gustavus M. Blech* (closing): Surgery seeks the ideal of eliminating itself. The highest ideal of surgery is not to operate. The highest reward a surgeon can get is the satisfaction of having avoided an operation. In cases in which by experience this is impossible of attainment, a surgeon does the next best thing. He tries to be as conservative as possible in order to save life.

If electrosurgery did not allow us to reduce the risks, which by common experience and years of tradition we know to be connected with so-called classic surgery, then all our time spent in discussing it would be completely wasted; but because it has that facility, or inherent quality that enables us to do much work conservatively, electrosurgery has become a valuable method.

I tried to point out that the best thing we can do is forget as much as possible the term electrosurgery, or any similar designation. Electrosurgery as we think of it destroying tissue by means of high frequency current is simply another one of the methods, or agents, of our complete and entire surgical armamentarium, involving early and correct diagnosis, scientific surgery and a certain amount of manual skill. If we have a broad concept of the biochemical problems, of the bacterial problems, of hemostasis, the proper technic will almost suggest itself in most operative procedures. Any differences of opinion in cancer of the rectum expressed today are mere technical problems, which each surgeon will solve to his own satisfaction as he gains experience by observation. Certainly if one can avoid a colostomy and radical destruction of normal structures such conservation will be the method of choice.

* Blech, Gustavus M., *Facts and Fallacies of Electrosurgery*. Arch. Phys. Therap., X-Ray, Rad., 14:519 (Sept.) 1933.

Dr. Max Thorek (closing): Dr. Bloch spoke of waiting a period of five years to ascertain whether or not the electrosurgical method of treating carcinoma of the rectum will compare favorably with the time-honored Kraske or its modifications. That has been done, and it has been found that the so-called inoperable cases—I am speaking of those surgeons who performed inoperable operations that have been studied by Kolischer, V. Seemen, and others—have 5, 6 and 7 years, let us not say cures, but retardation and arrest of conditions by none other than electrosurgical means.

Dr. McNealy is doubting our ability to destroy papillary growths or papillomas. I am frank to state that such is the case, that we do find early papillomata and that we can effectually destroy them without fear of jeopardizing the patient's future as far as recurrence of carcinoma is concerned.

Dr. Strauss has shown you a very fine group of slides. Of course, he does not claim originality for that because that work was described by investigators five and six years ago, but he does claim that he has done this work effectually. Besides, the question is not of academic importance. It is the patient who is to be considered, and never the theory. When a patient presents himself with a certain pathologic condition in the rectum, our purpose is not to ask ourselves whether Kolischer is right or wrong in his theory, or whether metastasization has arisen. This patient does not care about that. He seeks relief, and it is our duty to obtain this relief for him. A surgeon with a narrow view, a surgeon who says that his method is the best, is a dangerous surgeon. A thorough knowledge, learning from our predecessors in the past and the present, and a combination of all methods for the benefit of this class of patient is the only thing that will render early diagnosis, eradication, and cure of carcinoma of the rectum.

Dr. Alfred A. Strauss (closing): I think that the one important point that has been missed entirely is that by this method we are able to save the patient's rectum. I do not hesitate to say, as I said to this Society a year ago in New York, that it is no difficult task for a surgeon to remove the cecum and the ascending colon, and then the anus months later by the Mikulicz method, the ileum to the transverse colon, but to re-establish the physiological functions so that the man can go out normally in life and have normal bowel movements is another thing. I do not hesitate to remove the entire transverse

colon and its mesentery for carcinoma of the transverse colon because I can re-establish the continuity of that bowel. That patient goes out and has normal bowel movements and can go on in life as though nothing had happened up until the time of his metastases, if they do come on. But to go on and do a radical Kraske and divide the sigmoid and do the abdominal operation, and remove that man's sigmoid and rectum is quite another matter.

For that reason I cite these three cases that I want some of you gentlemen to examine. These are cases by electrocoagulation. One woman had an anular carcinoma. This young woman had no colostomy. She has been operated on I think over a year ago, and she now has normal bowel movements. She has gone on in life. She had children to take care of, and I feel, just because I have done many radical operations for carcinoma of the rectum that no such good results can be had from surgery. Everyone knows if you perform the ordinary Kraske of trying to excise the tumor you get recurrence down in the rectum, and if you do a radical surgical operation, removing the muscle, the patient has no more rectum.

Case No. 2 is a man in the fifties. He had no colostomy, but he had one thorough surgical diathermy. Anyone may take a glove and examine that patient's rectum, and it won't take a very smart doctor to tell if that rectum is smooth and there is no carcinoma left.

Patient No. 3 had a very extensive carcinoma of the rectum. To remove it surgically would necessitate removing her rectum and she would have an unnatural anus the rest of her life. This patient was operated by surgical diathermy, and then had an excision made of the scars, preserving the sphincters of the rectum. That patient is cured. She is cured for the time being, and she has normal bowel movements.

Dr. Max Thorek: How high up were they?

Dr. Strauss: All these carcinomas were within reach of the fingers. You could feel them in the anal region.

The point that I want to make clear is why I am adopting this method. If I can get as good results from surgical diathermy as I can from surgery and preserve at the same time the patient's rectum, I prefer this method. At least if I had a carcinoma that is what I would want done, because I would rather have normal bowel movements than wear a colostomy plug without a rectum, and I think that is the answer to the problem.

(Continued from page 75)

component of which may act in the nature of an antidote.

It might be possible, Dr. Reed, that your work

on viosterol with reference to the increase in basal metabolism and with reference to tetany may be used as a method for assaying viosterol. The present method is, indeed, very complicated.

PHYSICAL THERAPY IN INFANTILE PARALYSIS *

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CHICAGO

There are approximately 300,000 crippled children in the United States of whom forty per cent are the result of infantile paralysis. Legg has divided infantile paralysis into four stages. For complete treatment, especially as it is related to physical therapy, our own classification seems more satisfactory since we divide the disease into acute and chronic stages. Under the acute stage there are three divisions which have already been well described by others and are well recognized in the course of this disease; namely, the primary systemic phase, the secondary pre-paralytic phase, and the acute paralytic phase. With subsidence of the acute disease we reach the second or chronic stage of the disease, the early phase immediately following the acute attack, during which the patient is convalescing, and the later stage of fully developed paralysis. We will attempt to discuss only very briefly those branches outside the use of physical therapy and take up in greater detail the stages of this illness in which physical therapy is of value.

Acute poliomyelitis appears as a general systemic illness with upper respiratory or gastro-intestinal symptoms lasting three to five days and developing in a variable number of instances into the pre-paralytic stage of the disease. This stage is characterized by signs of meningeal irritation and early cord involvement, and it is during this period that a diagnosis can be made by a physical and neurological examination confirmed by a lumbar puncture, which discloses a fairly characteristic change in the spinal fluid constituents. As is well known, a certain percentage recover after this period without developing external evidence of paralysis. Others, however, develop into the third stage of the acute illness in which paralysis appears. The changes in the cord consist of marked interstitial edema, perivascular infiltration of round cells, minute hemorrhages, and necrosis of the nerve cells chiefly in the an-

terior horns. The destruction of the cell bodies are probably due both to direct action of the causative agent of poliomyelitis as well as to interference with the blood supply caused by the reaction to the infection.

The results are:

1. Scattered, irregular, widely spread loss of motor power on one or both sides.
2. No diminution of sensation of affected parts.
3. Diminution or loss of reflexes in parts affected.

The important point to remember in this stage is that the damage is done almost at once and that the result depends on the extent and location of damage and the judicious treatment of the patient in the early stage.

Treatment in this stage is wholly medical. The patient should be kept perfectly quiet, physically and mentally, because of the involvement of the cerebral meninges. The body should be placed in a position of physiologic rest. Posture of the patient at this point is important, as is the position of the limbs, to avoid bed clothes causing stretch palsies. Guarding position of joints is essential to support weakened muscles. It must be remembered that the central nervous system has received much shock and strain and that long continued rest is indicated. Drugs are of no value and electricity, massage and muscle training are to be condemned in this stage.

Symptoms and Management of Second Stage

The second stage begins as soon as the temperature returns to normal and lasts from a few weeks to two or three months. Further damage to the central nervous system is remote. At this point the edema subsides, the hemorrhages become resorbed and the motor cells which have remained viable resume their normal functions. But the cells which are no longer viable continue to degenerate while groups of phagocytic cells collect to remove this debris.

Tenderness and pain are present and the

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 11, 1933.

muscles show paralysis and weakness. The tenderness is extensive during the first and second weeks and diminishes from the second to the fourth week, the average duration being six weeks. Improvement begins just as soon as tenderness disappears. How far this improvement will go, no one can foresee.

The chief objectives in this stage are:

1. Relief of sensitiveness.
2. Prevention of early deformities.
3. Protection of muscles.

The sensitiveness — neuritis, and muscle soreness — is due to the marked edema of the cord involving the sensory areas. Treatment must be directed chiefly toward the relief of this sensitiveness and keeping the joints mobile.

Relief of Sensitiveness. During the first two weeks the patient should lie in the most comfortable position, on a Bradford frame well padded, and remain in this position until sensitiveness has subsided. As the tenderness diminishes during the second to the fourth week, the patient should be immersed daily in a hot saline bath at a temperature of 94 degrees F. The joints should be moved just a little, which hastens the disappearance of tenderness. The application of radiant heat is another means for relieving tenderness and should be applied daily. Frequent examinations are objectionable. A very light sponge followed by a light alcohol rub to prevent bed sores and chafing should be given daily.

Light passive motion is indicated, according to Legg, when limbs are immobilized any length of time. For example, the hips and knees are treated two times daily and are flexed and extended once or twice to the point of spasm. The other joints are treated in the same way.

Orthopedic Care. Early orthopedic care during this stage is of utmost importance. Complete immobilization with splints or plaster is essential for the prevention of contractures. In this phase, absolute co-operation between the physical therapist and the attending orthopedist is extremely necessary.

The essentials, then, of treatment during this stage are relaxation and rest. Fatigue, both general and local, must be guarded against. Massage, electrical stimulation and muscle training are contraindicated in this stage. For cerebral cases ice bags to the head may be used.

Convalescent Stage

The third or convalescent stage begins when the sensitive stage is over. It lasts from nine months to one year, and sometimes longer. It is during that period that the muscles make their greatest gain in power, and active muscle training should be carried out faithfully.

The products of hemorrhages are still being absorbed and the edema and perivascular infiltration are constantly diminishing. It is the time when the motor area of the brain is attempting to communicate with the affected muscles. Because the motor pathway is blocked, the power to execute certain movements has been diminished or lost.

The chief objectives of this stage are:

1. Complete muscle examination to show the extent of paralysis and the comparative strength of the muscle groups.
2. To stimulate circulation and increase nutrition.
3. To watch for and prevent deformity.
4. To promote relaxation and rest.
5. To protect muscles from overstretching.
6. To prevent contractures.
7. To favor the more important muscles until their recovery is assured.
8. To reeducate and strengthen the muscles by means of suitable exercise.
9. To be watchful of the general condition of the patient.

Intelligent application of physical therapy includes the use of heat, massage, electrical stimulation and muscle training, both in the gymnasium and in the tank. It is well to remember that in this stage all work must be done in a recumbent position.

Heat and massage are given to prepare the patient for the exercise program, as muscles respond more readily to exercise when local temperature is increased. Heat is applied to the point of erythema; usually a greater amount of dry heat can be tolerated. There are three types of heat, moist, dry and diathermy. Diathermy takes much more time, there is danger of burns, especially in small children, and there is very little advantage to be gained by its use. Radiant light is the one of choice. Moist heat, except in the hydrogymnastic pool, would be difficult to apply at this stage.

The application of heat is followed by massage, the chief purpose of which is to improve muscle tone, antagonize muscle atrophy, stimulate local circulation, thereby increasing the

flow of blood and lymph to paralyzed parts, preventing adhesions in muscles not usually active, eliminating waste products and stimulating nutrition, without fatiguing the muscles.

The kind of massage and technic of its application are of importance. At first the stroking should be very light, and later, petrissage or lifting of muscle from bone, rather than flattening against it should be employed, with just enough pressure to quicken circulation, together with a light friction around contractions, plus a definite, *careful stretching* of contracted tendons. Hoffa's technic is the one we use, the individual muscle groups being taken separately, and massage following the direction of muscle fibers with the stroke always continuous and upward from the distal to the proximal end. The direction is always with the venous circulation and never against it. Massage is contraindicated in the tender stage. Too deep stroking may cause paralytic dilatation of the vessels and defeat our purpose.

Electricity. There is a great difference of opinion in respect to the use of electricity. Generally the use of galvanic current is of no value whatever in increasing muscular strength. Faradism, though causing a contraction of the muscles, is very uncomfortable to children. The painful element, however, is much diminished by the use of the Smart Bristow Coil, which is faradism used in conjunction with a condenser. The weak point of this, however, is that it is difficult to confine the treatment to any one muscle, for the current spreads.

The rational use of electrical stimulation is based upon the following considerations: if the muscle is not fully paralyzed, but only weak, the production of contractions not only prevents atrophy of the paralyzed muscle bundles, but also exercises and strengthens the non-paralyzed part and thus enables it to do compensating work. In fully paralyzed muscles, electrical stimulation can cause movement similar to the normal ones, thus tending to preserve the functional properties of the muscle until normal nerve impulse returns to carry on the work. Sometimes even in older cases the improvement is very sudden.

Electrical stimulation by means of the galvanic or faradic current is given for its mechanical effect, which causes a contraction of the muscle fibers. The muscles in a case of

infantile paralysis are atrophied and therefore fatigue easily, because there is a partial or complete blocking of the motor pathway and impulses which maintain tone. Nutrition and muscular contraction cannot get through at all or very incompletely.

There is no evidence that any form of electrical stimulation can prevent atrophy and maintain tone and nutrition. However, clinical evidence seems to indicate that in the hands of the experienced, a mild sinusoidal current, just enough to cause a contraction, given to the point of fatigue, or the slowing of contraction, will preserve the functional properties of muscles until normal impulses return. Electrical stimulation should be abandoned as soon as there is a return of power.

Muscle Training

As muscle training forms the basis of treatment in this stage and the following one, it is important to give this phase thorough consideration. Muscle reeducation is that form of therapeutic exercise in which neuromuscular coordination has in some way become partially destroyed. The reflex arc has become involved, making it impossible for the muscles to move by means of the reflex mechanism. As a result, coordinated movement is lost. To reeducate muscles under such conditions two things are necessary: First, to reestablish a better coordination between the remaining nerve fibers and cells supplying the affected muscle, and, second, to secure the contraction of the desired muscle, however feeble.

However, before starting muscle training, it is of importance to grade the muscles which are paralyzed in order that the exercises may be properly controlled and located. If this is not done the patient is sure to use the strong muscles instead of the weak ones. On examination some muscles will be found weakened, some paralyzed and some comparatively normal. The grading of muscles is carried out as follows:

Absent — no muscle contraction felt.

Trace — muscle can be felt to tighten, but can not produce movement.

Poor — produces movement with gravity eliminated, but cannot function against gravity.

Fair — can raise part against gravity.

Good — can raise part against outside resistance as well as against gravity.

Normal — can overcome a greater amount of resistance than a "good" muscle.

The chief purposes of muscle training are the reopening of new neural channels from the brain to the muscle end plates, circumventing damaged nerve tissue, and developing weakened muscle fibers to a start of functional usefulness.

The operator places the muscle examination chart in a position in which it can readily be seen in order that one may see at a glance the muscles involved and the grading which they have received. The type of exercise given depends upon the grade which the muscle involved received. Therefore, the exercise program should be worked out at the time the muscle examination takes place. The exercise is then directed toward the weakened muscles. There are three general methods by which exercises are given. They are assistive, free, and resistive.

The assistive exercise is performed with gravity, or, if the part is in horizontal plane, by the operator gently assisting. Apparatus may also be used for assistive work and the utilization of buoyancy of water.

Free or unaided exercise is performed either by means of a smooth rectangular board well powdered and placed in a horizontal plane, as in water, by roller devices, or by means of slings.

Resistive exercise should be definitely graded, first by gentle resistance offered by the operator in a horizontal plane, second, against gravity by angling the board and again adding resistance to a degree the muscle can take, third, by adding weights and by means of apparatus.

In the technic of muscle reeducation, it is well to move the extremity passively through the arc of movement of the paralyzed muscle, before an attempt is made to obtain a contraction. If the muscle does not have the power to carry the extremity through the full range of motion of the joint it is gently and slowly assisted. In the first one-third of the arc of motion the leverage renders it difficult to start movement and it is in this arc that assistance is necessary. In the second one-third of the arc the leverage is better and more advantageous and free movement is possible. The last one-third of the arc leverage is at a disadvantage and again assistance is necessary. As muscle strength increases, the

exercises are free through the entire arc of motion, with graded resistance being given later. It is important to remember that paralyzed muscles are to be stressed and the stronger opponents are not to be exercised.

There are some points in muscle physiology which have a very practical bearing on muscle training. Each muscle is made up of many muscle fibers. Action or contraction of a muscle makes the individual muscle fibers shorter and thicker causing a chemical action with resultant waste products. These are usually removed by the circulation of blood, and fresh blood is brought back. This is helped by the mechanical pumping action of the muscle fibers and the joints on the blood vessels. If the circulation is not good there is an accumulation of waste products with a resulting loss of muscle power. The exercises should be given in slow rhythm, and time enough allowed between counts for recovery of the muscle. The muscle should be guided through its full arc of motion to establish habit reflex and better coordination.

Under-Water Exercises. The Hubbard Tank or under-water gymnasium constitutes one of the most important means of muscle training in the treatment of infantile paralysis. The warm water improves the circulation of paralyzed muscles, and the buoyancy of the water aids in the active movements of the extremities. It is readily seen that the three forms of exercise, assistive, free, and resistive can be carried out more easily in the water than in any other manner. For example, in assistive work, the buoyancy of the water lifts the limb to the surface. In free exercise, the part is placed on the surface of the water and here again the buoyancy of the water makes free movement possible in a horizontal plane. Lastly, in resistive work, the extremity is moved against the water, from the surface to the deeper part.

Dr. Lowman of Los Angeles places these cases in the tank as early as the fourth week, providing that the kidney condition is all right. He states that the advantages of under-water work are:

1. Treatment can be started early, saving four to six weeks.
2. There is a lack of gravity pull, freedom of muscular spasm and elimination of gravity in muscles too weak to function.
3. Morale of patient is bettered.
4. Body movements can be made in all

planes. Trunk turnings in recumbent position are made as symmetrical movements on a central axis as apart from asymmetrical ones as executed on a table.

5. There is a particular stimulus to movement in water.

6. Ease of movement in warm water encourages patients and prevents atrophy.

7. Absorption of inflammatory exudates in and about joints is aided, due to the heat and motion.

8. Buoyancy insures uniform resistive effects.

9. Metabolic processes in the neuromuscular system and joint structures are affected.

It is important to note that the temperature of the water should be 94 degrees F. and that the time of exercise in tank should not exceed fifteen minutes. Splints should be used in the water to protect weak muscles not under treatment. The importance of this type of exercise is so well recognized that a built-in tank should be part of the equipment of any modern hospital.

The chronic or fourth stage is regarded as that time when the rapid gain and spontaneous improvement is over. The condition apparently seems to be stationary, deformities are fixed, limbs atrophied, and shortening has taken place. It is during this stage that exercise is given in sitting and standing positions, and braces are applied to allow locomotion and to prevent or correct deformities. The patient is taught how to walk by means of a walking device and crutches. It is at this time, also, that operative intervention is brought into play. Physical therapy is continued just as previously and may be kept up indefinitely, as long as improvement continues. No definite prognosis can be made about muscles which appear to be completely paralyzed, except, that about 50 per cent of completely paralyzed muscles do regain some power, and that some of them recover normal strength if properly treated. As regards the outlook of the patient, it is well to keep in mind that practically every patient will show some improvement under proper treatment, but it is impossible to tell how much until it has been tried.

Summary

A summary of rules for muscle training are:

1. Avoid overfatiguing a muscle by over-

treatment, by performing a movement rapidly, or too many times.

2. Make each movement a voluntary active one performed by the patient in response to a stimulus. If no power is present, the patient should attempt the motion with concentration while the operator carries out the motion "with help." The patient should be instructed not to return the part to the starting position, but to relax after each effort and allow the operator to do the return movement passively.

3. See that the full arc of the motion is obtained each time. If necessary, help should be given in completing the arc, being careful to allow no pause at the point where the patient's strength gives out.

4. Localize the exercise by fixing the adjoining parts of the body so they will not take part. This is both to insure maximum concentration and effort in the desired action, and also to prevent substitution of other muscles. It is better to give one movement at a time than a combined movement of two parts at the same time; and if it is desired to give both flexion and extension exercises to the same joint, it is better to give them as two exercises with a rest between rather than have the patient attempt to exert his maximum effort during both parts of the exercises. Passive replacement of the part gives a chance for recovery before the next effort.

5. Give resistance to develop strength wherever possible. It should not be given until the muscle is able to complete the arc of motion unaided, and if given, it should always be a little less than that which would stop the movement or make it jerky, and should be graduated to leverage throughout.

6. Radiant heat with massage is desirable before each treatment, to stimulate the circulation and to enable the muscle to give a better response.

7. Ordinarily treatment is given once a day, six days a week. It is best to have each exercise done twice, at first, gradually increasing the number until it can be done ten times without fatigue. The whole treatment, including massage, takes from twenty minutes to an hour, depending upon the extent of paralysis. It is preferable whenever possible to have two short exercise periods a day rather than one long treatment.

8. If the splint or apparatus is removed,

care should be taken not to allow the part to hang, and no stretch or strain should be allowed on the muscles which are being kept shortened in the splint.

9. Always have the part which is being exercised uncovered.

10. If possible, be alone with the patient in order to secure his entire concentration.

Passive movement is useless for restoring muscle power. There must be attempted voluntary movement until active movement is achieved. Static exercise, which is contraction and relaxation of muscles without movement of joint, may be added to this form of muscle training and may be performed during the day.

Other Forms of Treatment. Bordier advocates early roentgen therapy and both Granger and Bordier use diathermy to the involved part for its circulatory effect.

An important use of the Drinker Respirator in the after care of infantile paralysis is brought out by Legg of Boston. He states that in cases of paralysis of the intercostal muscles and accessory muscles of respiration, the Drinker Respirator is of distinct value in that it prevents fatigue of these muscles by producing chest expansion and breathing without muscular effort. The action is entirely passive motion, without fatigue. The increased aeration of the lungs and the deeper movement of the diaphragm resulting from the use of the respirator should be an aid to the general health of the patient, in addition to its value in preventing deformities of the chest and in aiding the return of power to the muscles of respiration.

Conclusions

In conclusion, it can readily be seen that physical therapy is indispensable in the treatment of infantile paralysis. Heat, massage and muscle training are the most effective measures. The earlier proper physical therapy measure can be employed after the first stage the more satisfactory will be the results.

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Discussion

Dr. John Stanley Coulter (Chicago): In the treatment of infantile paralysis we appreciate the value of heat and massage, underwater exercises, and muscle training. There is one particular phase of treatment in which we should be particularly interested, that is, the value of electrical muscle stimulation in peripheral nerve injuries and in infantile paralysis, about which to date very little has been proven. I believe it is time for men interested in physical therapy to investigate this problem along scientific lines to definitely prove or disprove the value of this form of therapy. It is peculiar to note that orthopedists do not use muscle stimulation. On the other hand our neurological department uses electrical muscle stimulation in all their cases, believing from clinical observation that it has a value, which is not scientific proof.

In our physical therapy department we try

never to give electrical muscle stimulation unless we use some form of muscle training, because it is very easy for the muscle to acquire the habit of moving only under electrical stimulation. We never introduce electrical muscle stimulation except to provoke gentle and minimal contractions, and that only when the muscle is in a position of physiological rest.

For example, if one treats a wrist-drop one should not give electrical muscle stimulation when it is in extreme flexion. The effects are injurious and the results disappointing. If we have a wrist-drop we place it in a cocked-up position and give only two or three contractions at one sitting. We always use the underwater exercises, which is one of the distinct contributions to the treatment of infantile paralysis.

Dr. Sidney Sideman (Chicago): My definition of orthopedic surgery is that branch of surgery which deals with the correction and prevention of deformity and the preservation and restora-

tion of function. Therefore, infantile paralysis is an ideal disease for the orthopedic surgeon. Physical therapy has long been used in similar conditions but it was not a well organized and recognized medical practice until the orthopedic surgeon took command and pushed it to the front. For that reason orthopedic surgery and physical therapy are the best possible combination for the treatment of infantile paralysis.

It is unfortunate that these cases are at first seen by the general practitioner, the pediatrician, the neurologist, and sometimes the internist. These men often treat their infantile paralysis cases during the acute phase, up through the sixth, eighth or tenth week. When deformities have developed they call in the orthopedic surgeon, and the orthopedic surgeon is confronted with a problem which is quite difficult both to analyze and to treat. The orthopedic surgeon does his share, but he in turn calls in the physical therapist, but both should have been on the scene at the onset of the disease.

PHYSICAL THERAPY OF THE SCIATIC SYNDROME *

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The coining of the expression "sciatic syndrome" was necessary as the term *sciatica* did not imply all pathological processes which gave rise to sciatic pain. In view of the fact that the diagnosis *sciatica* was so often associated with a definite therapy, routine treatment was bound to be disappointing.

The sciatic nerve is the longest nerve in the human body, extending from the vertebrae to the tips of the toes. Considering that we project most of the impulses coming through the nerves towards the periphery, according to the distribution of the nerve, it is obvious that every pathological process in and around the nerve gives rise to symptoms, particularly pain, which the patient localizes into the periphery regardless of its seat. If we want to establish this latter as well as the character of the pathological process which causes these symptoms we must look for other objective signs.

Disregard of this point has been and still is the reason for so many unsuccessful treatments. I have often stressed the neces-

sity of correctly localizing the pathological process. Unless we do so and direct our treatments accordingly, our efforts will be wasted.

Pain in the sciatic nerve, the sciatic syndrome, may develop if the sciatic nerve is affected anywhere in its course; that is, in the spine, in the roots, or in its peripheral course. Yet the subjective signs may be the same in all cases. I cannot stress this strong enough as I have noticed that even in papers which treat of the various causative processes no mention is made of the necessity of administering the treatments to the affected parts instead of to the nerve as a whole.

Causes of Sciatic Syndrome

Pathological processes in the spine underlying a sciatic syndrome may be a tumor, a spina bifida, a disease of the spinal cord, or a spondylitis. It is characteristic that in these cases the nerve itself is not sensitive to pressure. Indeed there is no reason for such a sensitiveness as the nerve and its sheath are normal. Often not even the Laségue symptom is present. The differential diagnosis is sometimes revealed by

* Read before the Eastern Section of the American Congress of Physical Therapy, Philadelphia, May 6, 1933.

a roentgenogram or by tenderness of the corresponding vertebrae. We can gain an important indication from the reaction to treatments. It requires no argument that no local treatment of a conservative nature will affect the pain which is caused by tumors, spina bifida, or tabes dorsalis. On the other hand we may expect a result from diathermy in cases of spondylitis if the treatment is applied to the diseased vertebra. The improvement after the first treatment may be only temporary, the pain may even increase greatly the next day, but without the initial improvement I should not like to make the diagnosis spondylitis as the cause of the sciatic syndrome. Aggravation after the treatment may indicate only the existence of an active focus.

If the spine is not sensitive, the nerve not tender to touch, the roentgenogram negative, and the distribution of pain the usual one, we must think of a radiculitis as an analogy of the radiculitis in neuritis brachialis. In some of these cases the distribution of the pain may indicate that not only the roots forming the sciatic nerve but those of the crural nerve are involved. These forms are due mostly to focal infections. Diathermy applied alongside of the lower dorsal and the lumbar spine is extremely valuable except in cases which are under the influence of an active focus.

In another group patients complain of severe pain while sitting due to pressure on the nerve trunk. The nerve is very sensitive to pressure all along its course, in the middle of the thigh, along the outer side of the calf. In some cases the pain is increased by gentle massage of the nerve (sciatic neuritis), in others it is distinctly relieved. The latter form may be due to a toxemia (constipation, mild focal infection). In this form treatment of the roots is useless. Visible light to the entire leg followed by very gentle effleurage, high tension currents with the Oudin electrode or the static brush discharge, diathermy with one bifurcated cord, so that the electrode coming from this terminal is applied to the region of the notch and the foot, the other electrode coming from the other terminal being applied above the kneecap, are frequently of great value. Often iontophoresis helps, using two long narrow electrodes in

the front and the rear of the leg well padded, positive pole in the rear.

Treatment of Acute Stage

In the acute stage bed rest is imperative. Hot baths frequently reduce the pain. A strong erythema dose of ultraviolet rays of 2900 to 3100 A.U. is valuable through its derivative action. Many patients have great difficulty in getting about. They force themselves to go to the office of the physician for treatment with physical therapy methods. I have found this procedure very frequently harmful and interfering with the therapeutic action. The effort of moving, dressing and undressing, the injury to the nerve in transportation, be it in a car or in a railway, the possibility of catching cold after exposure to heat are disadvantages which far outweigh the benefit which might be derived from the treatment. The acute and subacute cases are best treated at home or in a hospital.

It ought to be mentioned that cases suffering from an affection of the roots and the trunk should be simultaneously treated with epidural injections. If the nerve is injured, be it by violence, injection of medications, for example, mercury, attention must be paid exclusively to the local process. Sometimes it may even be advisable to free the nerve surgically from adhesions. Of physical therapy methods visible rays but particularly diathermy applied to the injured spot will increase local circulation and absorption of the exudate.

Symptoms Simulating Sciatic Pain

We have mentioned those forms of sciatic syndrome which show definite involvement of the nerve somewhere in its course. There are, however, many patients who complain of pain in the leg without an involvement of the joints or bones, without any objective signs such as changes in the reflexes. It is, of course, often impossible to judge the character of the pain of which the patient complains. The nerve and the spine are not sensitive to touch, the distribution is not characteristic. We must in such cases remember that the sciatic syndrome, if we may use this term here, may be only a reflex, a pain referred to the periphery, but due to a pathological process in the pelvic bone, in the pelvic cavity or in the sacroiliac synchondrosis.

I have seen cases that resisted the treatment of their alleged sciatic syndrome but who were promptly relieved by a gynecological operation. In these particular cases it is important to notice the lack of immediate results of physical therapy, especially of diathermy and massage. Such patients can obviously not respond to treatments directed to the sciatic nerve. As said before, we are unable to analyze correctly the sensation of the patients and are therefore often inclined to distrust them, to consider them to be hypochondriacs and neurotics. It is very important to take the patients complaints seriously, even if we cannot find a cause for them. Experiences as those mentioned should teach us to take refuge to the term neurosis only, if many other signs point in that direction.

One more word about bilateral sciatica. When I was a student we were taught never to make the diagnosis double-sided sciatica. This is true to some extent. An affection of both sciatic nerves in their peripheral course is very rare, if they ever occur. Some patients however complain of pain in both legs just along the sciatic nerve. This is always a sign of an affection of the spine. Treatment of the spine will in most cases which are at all amenable to treatment lead to a quick cure.

Conclusions

Sciatic syndrome is a collective term for pain in the distribution area of the sciatic nerve. It may be due to a variety of causes. It is necessary to establish the pathological process giving rise to this symptom complex. Treatment, to be successful, must be directed against the seat of the pathologic process.

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Discussion

Dr. Josef B. Nylin (Philadelphia): As Dr. Wolf has pointed out, the designation for pain in the region of the sciatic nerve distribution, "sciatic syndrome" is a distinct improvement over the term "sciatica," since the latter would indicate a clinical entity. On the contrary, this symptom complex may be due to various etiological factors, each requiring a different mode of treatment. It is, therefore, of the utmost importance that a thorough search be made for the causative factor in every case presenting these symptoms in order that a rational treatment may be possible. It is evident, for instance, that, if the sciatic syndrome is secondary to a general disease such as diabetes or lead poisoning, or to pathological changes in the pelvis, such as pres-

sure from a tumor, physical therapy measures applied to the region of the sciatic nerve would be altogether useless. Successful treatment of the primary causative factor, on the other hand, is apt to bring about a complete cure of the sciatic syndrome.

Dr. Wolf has performed a good service in having emphasized in his paper the importance of treating this syndrome according to its etiological genesis and in having stated the physiotherapeutic measures indicated in the principal varieties of this symptom complex. As my views on this subject concur on the whole with his, I shall confine myself chiefly to enlarging somewhat on some of the points he has brought out.

In the treatment of true sciatic neuritis, rest of the affected leg, and gentle heat to the region of the diseased nerve are the physiotherapeutic elements of chief importance in the acute stage. The required rest is best secured by recumbency in bed. As to heat, diathermy is particularly serviceable at this stage because of the ease with which the electrodes can be slipped under the part to be treated without the slightest disturbance of its position.

In the subacute and chronic stages, diathermy by the through and through method has perhaps in my experience given the best results. A long narrow electrode is applied to the back of the leg and a disbarsive electrode to the front of the limb. However, baking of the affected region or hot water baths are frequently equally beneficial treatments. If hot baths are employed, the patient's buttocks should rest on an inflated rubber ring, and the water should be raised gradually to the point of tolerance while the patient is in the bath. Massage in the form of very gentle stroking may be administered immediately following the heat procedure instead of the static brush or the Oudin current, particularly if the latter modalities are not available.

Not infrequently myositis in the vicinity of the sciatic nerve trunk is the causative factor of the sciatic syndrome. This is true especially of the gluteus maxims and the gluteus medius muscles. The myositic deposits, in most cases, can be discovered by careful palpation. In this variety of sciatic syndrome massage of the affected region forms an important therapeutic element. The massage, which should be preceded by heat, such as baking or the luminous or infrared lamp, or by through and through diathermy, should consist of strokings of the whole limb and the gluteal region, and frictions and manual vibration over the whole extent of the nerve trunk with the objective of facilitating the disintegration of the infiltrations and their removal by movable pressure through the lymphatics. They are furthermore likely to bring about a stretching of adhesions which may have formed between the nerve sheet and surrounding tissues. If the inflammatory changes are limited to the gluteal muscles, the treatment is confined to that region.

In the variety of sciatic syndrome due to arthritis of the lower lumbar spine, I concur with Dr. Wolf in the statement that diathermy of the affected part yields the best results. The anterior-posterior method should be used.

PHYSICAL THERAPY IN SKIN DISEASES *

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Our modern offices, with the varied apparatus now in every day use, present a picture far more complicated than that of the older dermatologist, whose prescription pad was his sole therapeutic weapon. That he made the most of what he had at hand we all admit, just as we acknowledge our debt to the older clinicians who made such keen observations without benefit of laboratory and roentgenologic studies.

Much as we may admire them and be fascinated by stories of those rugged men of former days, we cannot turn back the years. The "good old days" always have seemed attractive from a distance—yet who would return to them if he could. Just as our present communication and transportation facilities have replaced those of the past, the physical agents of today have put some of our past therapy into the discard. While the prescription pad is still the cornerstone of dermatological therapy, it no longer stands alone. It has had its way made easier in many directions through intelligent use of the various physical agents at our disposal. In the cutaneous malignancies it has of course been supplanted entirely, and in other conditions it has been relegated to a subordinate position.

While these physical agents have greatly improved dermatologic therapy, they have also brought new problems and a need for certain technical knowledge unknown to the older dermatologist. The automobile driver of today faces different traffic conditions from those of the old horse and buggy driver. He cannot "throw the reins" as did the latter and go to sleep for a while. Neither can the modern dermatologist just "turn on the juice" and let the machine run. In addition to the fundamentals of dermatology, which are just as important as they ever were, he

must possess a working knowledge and an appreciation of the various pieces of apparatus he employs. This, we think you will agree, includes not only an understanding of its mechanics, but also of the why and the how of its local systemic effect upon the patient and the disease. He must also know its limitations, indications, and contraindications, and the part it plays in relation to other therapeutic measures being used.

We are not here to tell you about the agents themselves, for that would indeed "be carrying coals to Newcastle," but we have come to acknowledge our indebtedness and to receive from you today new ideas and further information helpful in our work.

X-Rays

Of the agents in use today, the x-ray is undoubtedly the most important to the dermatologist from the standpoint of everyday use. While fully realizing that a discussion of x-ray therapy is of little interest to the physical therapist, its importance in the therapeutic armamentarium of the dermatologist is such that it must of necessity be discussed. Mackee has listed about 80 dermatoses that are more or less amenable to x-rays. He furthermore states that "in some instances the roentgen rays constitute the only remedial agent that will cure or control a skin disease or give relief from distressing symptoms."

For the majority of cutaneous diseases the roentgen ray should be used only as an adjunct to other therapy. This applies particularly to the treatment of such common diseases as acne vulgaris and rosacea, eczema, psoriasis, tinea infections, etc. In the treatment of acne vulgaris no other form of therapy has given as good and comparatively rapid results as the roentgen rays. Criticism of this agent has been that it leads to de-

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vitalization of the skin and that the resultant scarring from pustular lesions is greater. This does not happen when fractional doses are given in a total amount not exceeding 3 skin units, or measured in the newer international roentgen unit, a total of not over 1000 R units.

We minimize the value of roentgen therapy to the patient as there is a tendency on the part of some few of them to become x-ray addicts. This applies particularly to patients with localized patches of psoriasis or eczema which in most cases respond promptly to x-ray therapy making this therapeutic procedure more popular than dietary regimes or local applications.

While the x-ray alone will often cause the disappearance of a basal cell epithelioma, in most cases a combination of electrodesiccation or coagulation and roentgen therapy is preferable. This is certainly true of the prickle cell epithelioma.

In recent years roentgen rays have been used indirectly with benefit in certain dermatoses—namely, by application over spinal ganglia. Barcat states that when used in this way they exercise a remarkable calming power on nerves, relieving congestion, pruritus, and trophic disturbances. Thus they have been employed in the treatment of lichen ruber planus, pruritus, urticaria, dermatitis herpetiformis, herpes zoster, and other dermatoses. We have found x-ray therapy to the spinal ganglia of immeasurable value in relieving the pain of herpes zoster.

Grenz Rays

These rays are less widely used than ordinary x-rays, although it is claimed that they are less hazardous. Their wave length is longer than the more commonly used x-rays and they are absorbed largely by the epidermis. The Grenz rays have been advised in the treatment of eczema, psoriasis, lichen planus, and circumscribed rebellious eruptions in infants and children.

Radium for Cutaneous Lesions

In general, radium is used much less frequently by the dermatologist than the roentgen rays, and in most hospitals its use is under the control of the roentgenologist. We have found its value lies chiefly in the treatment of the following: epithelioma, sarcoid, hyperkeratosis, clavus, callositas, verruca

plantaris, leukoplakia, senile keratoses, vascular nevi, keloids, and hypertrophic scars. To have a half or full strength plaque of radium in one's therapeutic equipment is to possess an agent which may not be used frequently, but may prove of great value in selected cases. We disapprove placing entire reliance on radium for the cure of skin epitheliomata, believing that better results are procured by electrodesiccation or coagulation followed by x-ray or radium.

Ultraviolet Rays

Ultraviolet irradiation is of far less value to the dermatologist than roentgen therapy, and contrary to the claims put forth by the manufacturers of these lights, there are but very few dermatoses that respond to ultraviolet rays alone. We have been favorably impressed by the results achieved in our clinic at Temple in the treatment of acutely inflammatory types of acne, although improvement is often only temporary, and probably due to the resulting desquamation and feeble bactericidal action. Cutaneous tuberculosis and erysipelas respond favorably to ultraviolet rays, although in the latter condition it has been our observation that x-ray therapy is of greater value. The Finsen light has proven beneficial in the treatment of cutaneous tuberculosis and remarkably good results have been reported by Reyn, of the Finsen Institute. Reyn prefers the carbon arc light because its spectrum more nearly approaches that of sunlight.

That the ultraviolet rays hasten the return of hair in alopecia areata is generally accepted, but very few dermatologists have any faith in promoting hair growth in cases of premature alopecia. In defluvium following an illness, ultraviolet rays may have a restorative influence and should be used.

Other dermatoses in which its action is fairly well established are adenoma, sebaceum seborrhea, pityriasis rosea, psoriasis (particularly when preceded by application of coal tar), telangiectasia, and certain types of ulcers.

We have repeatedly warned patients against the uncontrolled home use of ultraviolet radiation. Ultraviolet irradiation is by no means harmless and it is our belief that it should be used only under the constant supervision of a physician. As Mackee has pointed out, it may change a quiescent in-

flammatory dermatosis into an acute active eruption, and even into dermatitis exfoliativa. All dermatologists see cases of lupus erythematosus and herpes simplex in which ultraviolet rays have proven to have been the precipitating cause. We have urged against the use of massive doses of ultraviolet rays preferring mild erythema doses.

We also wish to call attention to the frequent good results of using generalized ultraviolet irradiation for its tonic action. This is particularly useful in the treatment of furunculosis and carbunculosis, tuberculosis of the skin, infantile eczema, and chronic urticaria.

Diathermy

While medical diathermy, or the application of a bi-terminal high frequency current for medical purposes is used by dermatologists only in giving fever therapy to selected cases of central nervous system syphilis, surgical diathermy is a part of everyday dermatological practice. It has supplanted the formerly used desquamating or necrotizing pastes, soldering irons, and to a partial extent electrocautery, in the treatment of verrucae, nevi, and various other cutaneous new growths. In dermatology three types of high frequency currents are used, namely, the cutting, the coagulating, and the desiccating currents. Whether one uses the monoterminal or bi-terminal current depends upon the experience and judgment of the operator and the requirements of the case at hand. Lately there has been a growing tendency to use the desiccating current almost to the exclusion of the others, for it does not produce complete necrosis of tissue and thus promotes more rapid healing and a smaller, softer scar.

The cutting current, however, must be regarded as of considerable value. With it an extensive growth of the skin can be circumvallated, with searing of the smaller vessels and blocking off of the blood and lymph channels. It is also valuable for biopsies. By reducing current to a minimum, coagulation is lessened and the section of tissue is not ruined for microscopical examination.

These various forms of surgical diathermy may be employed for a variety of cutaneous lesions. We are using electrodesiccation for the removal of seborrheic and senile keratoses, verrucae, and various types of nevi including small elevated vascular nevi. Elec-

trocoagulation has been the method of choice for malignant neoplasms, although we have been turning more and more to electrodesiccation for these lesions. Use of the cutting current has been discussed.

Galvanic Current

For the removal of superfluous hair electrolysis must still be regarded as the treatment *par excellence*, although cosmetic results are not all that could be desired. The galvanic current has been used in the treatment of port wine marks. The late Dr. G. Betton Massey used an electrode with half a dozen needles mounted in brass, with a hard rubber sleeve to limit their penetration. The needles were inserted into the nevus and a current of one to two milliamperes per needle was employed. This was repeated in a different area at intervals of 2 to 3 weeks. This method of treatment should be given further consideration as port wine marks are notably difficult to treat.

Direct application of galvanic current has been recommended by Jeanselme, Bourgnignon and Lucas in the treatment of scleroderma, placing a negative electrode soaked in a one per cent solution of potassium iodide on the lesion and a positive electrode soaked in water nearby, and passing the current through the patch.

Cautery

The small thermal cautery which may be purchased for a small sum and connected with any light socket has for years been a valuable agent for dermatologists. In the past few years it has been largely supplanted by surgical diathermy but being easily portable is invaluable when one must go to a patient's home to remove a keratosis or other small cutaneous growth. We still employ it in clinic and private practice for the removal of small verrucae and nevi. Dr. Frank Krusen is of the opinion that there is more charring from the cautery than from electrodesiccation and that the resulting scar is greater.

Carbon Dioxide Snow

Used since the beginning of the 20th century, the application of carbon dioxide snow is still the method of choice in the treatment of small elevated vascular nevi. These are usually cured by from one to three applications of from 30 to 45 seconds, using moderate pressure, and the resultant scar is

smooth, white and soft. Light pressure from 10 to 20 seconds will remove flat pigmentations. Carbon dioxide snow may be used to treat warts, moles, or small discoid patches of lupus erythematosus, although seldom used for these conditions today. With the present day widespread use of dry ice in packing ice cream, fruits and vegetables, ready prepared carbon dioxide snow can be procured at almost any corner drug store.

Lortat-Jacob has described a new method of applying snow to which he has given the name cryo-cautery. The gas is collected in a copper chamber and after intensifying the cold with acetone the surface of the copper chamber is applied directly to the lesion. This apparatus has the advantage of having a spring gauge which accurately controls the pressure—a factor that is difficult to estimate accurately when carbon dioxide snow is directly applied.

Comment

Any discussion of physical therapy as used by the dermatologist must necessarily entail a discussion of certain agents that are not used by the physical therapist, such as x-ray and radium. However, the dermatologist's debt to the physical therapist is a considerable one for refinements in the technic of those agents which we both employ. The future will undoubtedly see the development of many more physical agents and further application of those now in use, and we sincerely trust that this will be so. We know that certain physical aids are essential to good dermatological practice today and have an earnest desire for cooperation with the physical therapist rather than a feeling of competition.

Discussion

Dr. A. Strauss (Philadelphia): In giving physical therapy the place it deserves in relation to the practice of dermatology, I was glad to hear Drs. Wright and Guequierre also sound a note of conservatism and call attention to the limitations and contraindications for its use.

To what extent we have all been influenced by commercial electrical apparatus manufacturers is a question that should be properly considered. Undoubtedly the widespread use of the mercury—quartz and similar lamps was brought about by this influence and the authors have well em-

phasized the potential harm that lies in their indiscriminate use. In spite of all the claims made for these lamps, they have a very limited use in dermatology.

X-ray has perhaps justified itself more than any physical agent we have at our command in dermatology. One often wonders how our predecessors were able to obtain the results they did without its use. The term "X-ray addicts" as used by the authors is a very apt one. It is surprising the number of patients who insist on getting unlimited quantities of x-ray and when refused it by one doctor will go to another. One can readily understand their viewpoint, for one or several doses of x-ray will give relief and clear up skin lesions that resist other methods of treatment.

Surgical diathermy plays a big part in our practices today and I am inclined to agree with the authors that it is the most useful agent we have next to the x-ray. The end results following its use are surprisingly good both from a cosmetic and curative standpoint. Perhaps a little more emphasis ought to be placed on the electro-cautery which has been rather neglected since the introduction of surgical diathermy.

Dr. Edward F. Corson (Philadelphia): Doctors Wright and Guequierre have given us an excellent cross section of physical therapy insofar as it applies to dermatology. No skin specialist can properly fulfill the provinces of his branch without a certain amount of skill and the necessary equipment along these lines. When I first entered the field few dermatologists possessed qualifications or means to employ more than three of these therapeutic agents. The x-ray then was best described as a cranky, sputtering gas tube ever becoming harder in spite of occasional efforts to soften it. Carbon dioxide snow and galvanic electrolysis largely divided the field now mainly covered by electrodesiccation and coagulation. We are sensible however that our procedures are for the most part dwarfed in comparison with the much more extensive operations of the full time physiotherapist.

I think that those who work in dermatology see much more of the x-ray addict than do others employing that machine. In many instances the patient is so much pleased by his improvement by this agent and his freedom from other irksome form of treatment, that he becomes most enthusiastic over his new discovery. Unless he is most thoroughly informed as to its potential dangers, he will pursue this form of treatment, changing physicians and even concealing important knowledge of past exposures lest his new attendant discontinue his favorite remedy. Instances are not lacking where a patient has, intending to hurry the cure, taken x-ray treatments from two doctors at the same period, each, of course, being unaware of the others effort.

RADIUM IN LESIONS OF THE CORNEA *

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and

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In reviewing the literature of the last two years, we have been impressed by the scarcity of publications in the American journals on the use of radium in the treatment of corneal lesions. More work is being done abroad with radium and the roentgen rays than in this country, if the available literature is any criterion. Much has been written about the use of radium in the treatment of neoplasms about the orbit and the development of cataracts as a result of radium and roentgen rays, but relatively little on its use in corneal and other benign lesions.

We present our experience with radium in the four following conditions; i. e., trachoma; maculae and opacities of the cornea treated with radium alone; leucomas of the cornea treated with radium and surgery; post-operative recurrent pterygia treated with radium only, emphasizing our points briefly with case reports

A. N. Kruglov and G. S. Liorber reported the effect of radium on 25 cases of trachoma in stages one and two. Improvement was noted in 19 cases. In cases with pannus they thought that radium did more harm than good. (This is contrary to our experience as we will show shortly and also contrary to the experience of others.) These authors prefer radium to roentgen ray. Four capillary tubes containing 8 mg. of radium element with a 1 mm. copper filter were placed upon the eye lids for periods of 1 to 4 hours. The interval of treatment was 1 to 2 weeks, and as many as six were given.

We wish to report our experience in one case of advanced trachoma with extensive bilateral pannus and staphyloma of the cornea of the right eye. Small doses of radium were used over a long period of time with improvement.

L. S., white, male, age 16 years, was admitted to the Texas School for the Blind in 1931, because of

blindness due to trachoma. His mother had had the same trouble for years.

Examination: The eyes are unequal in size. There is much secretion.

Vision: O.D. Light perception. O.S. Light perception.

O.D.: The upper and lower palpebral conjunctiva shows marked trachomatous changes. Scar tissue, extending from the lids to the globe restricts its motion. The cornea is completely opaque and very staphylomatous. The iris is not visible.

O.S.: The palpebral conjunctiva, upper and lower, is similar to that of the right eye. There is extensive pannus but no staphyloma. The iris is visible only in the outer temporal quadrant.

The patient was treated with mercurochrome 1 per cent three times daily in each eye and bichloride of mercury solution (1-500) was applied daily to the upper and lower lids with an applicator. The patient improved, the secretion decreased, and the pain and burning subsided.

Radium treatment was begun February 25, 1932. At first it was passed over the cornea, using the same technique as in cases of corneal opacities. On May 26, 1932 the patient had received a total of 5.3 mg. hours of radium to each eye. Vision in O.D. was hand movements at 12 inches; in O.S. hand movements at 18 inches. Mercurochrome and bichloride of mercury were discontinued only on the days radium was used. Treatments were discontinued during the summer vacation.

During the current year, 1932-33, the patient has received a total of 10 mg. hours to each eye. The technique was altered a little in that each upper lid in succession was everted and exposed for 5 minutes. Each lower lid was pulled down and treated in the same manner. The interval between treatments was 4 to 6 weeks. No screens were used. The radium was passed over the exposed surface at a distance of 2 mm.

May 5, 1933 the vision had increased as follows: O.D. hand movements at 18 inches; O.S. hand movements at 2 feet. There has been no secretion for the past year and steady improvement. Next fall we hope to do an iridectomy in the left eye, which if successful, should improve his vision considerably.

Dr. Laura A. Lane has written of the excellent results with radium in the treatment of maculae and opacities of the cornea. At the meeting of this society last year, she reported several cases, some of which I had had the privilege of assisting her to treat. Dr. Lane

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has done much to advance our knowledge of the correct use of radium in ophthalmology. Up to the present time, more than 10 years since she began the use of radium, she has not been unfortunate enough to have cataracts develop as a result of her treatment of eye lesions.

If one studies the literature of these cases of irradiation cataract, one will be impressed by the fact that the cataracts developed after large exposures of radium or roentgen rays, often made with little or no screening, also that the cataracts were a secondary complication of the original condition. Blegvad, Gualdi, Peters, and others have described such cases of cataract. The cataract has been found to develop about 165 days after exposure and begins at the posterior pole.

In our own work thus far we have not noticed the development of a radium cataract in any of our patients. We attribute this good fortune to the fact that small doses of radium are used over long periods.

The following cases illustrate how much benefit can be derived from the fractional treatment method with radium.

Mrs. Ed. D. St., white, married, age 32, came first January 30, 1925, complaining of sensitiveness to light. As a child, she had had severe sore eyes. Since then she has had attacks of "fluid secretion" at different intervals. Examination showed a left central corneal opacity, macular in type. The right cornea had a nebulous haze. Vision in O.D. was 10/200, and in O.S. 14/200, which was improved under homatropin with a plus 3 sphere and a plus 2 sphere, respectively, to 10/25 in each eye.

On January 22, 1931, the patient returned with a 2 mm. corneal ulcer near the nasal margin of the right eye. The left eye was quiet except for a catarrhal palpebral conjunctivitis. Mercurochrome $\frac{1}{2}$ per cent was prescribed for the right eye and boric acid gr. X to the ounce for the left eye. The patient improved, was discharged on January 31, and advised to continue the above treatment.

On March 17, 1931, she returned with bilateral corneal ulcers. Under treatment the ulcers healed. On May 23, 1931 there was a rather large central opacity in each cornea. The vision was 20/100 in each eye. The patient disappeared and was not seen again until August 2, 1931, at which time radium treatment was started. 10 mgs. of radium, passed 2 mm. above each cornea, was used for 4 minutes. On the 10th and on the 20th, the exposures were increased to five minutes in each eye. The patient was ordered to return every three or four weeks. She was irregular in reporting for treatment. A total of 6.8 mg. hours was used on each eye.

The patient was last seen June 17, 1933, at which time the corneal opacities had decreased remarkably in size and were much less distinct. The vision, with correction, in O.D. was 20/24 and in O.S.

20/49, a decided improvement over the former condition. We have advised continuation of the radium treatment.

Case 2. Lera W., white, single, age 17, school girl, was first seen November 15, 1932. She complained of defective vision in the left eye. She denied ever having had any pain or inflammation in this eye. On examination, vision in O.D. was 20/20 and in O.S. 20/25. There was a superficial, small opacity half way between the pupil and the margin of the cornea.

On January 7, 1932, the opacity had increased in size and a small ulcer was present. The vision in the left eye had decreased to 20/35. The Wassermann reaction was negative. The tuberculin test was positive. The patient refused tuberculin therapy. Under treatment, the ulcer healed, but the vision remained diminished.

On February 1, 1933, 10 mgs. of radium element in a platinum needle was passed back and forth, at 2 mm. distance, over the left cornea for 3 minutes. The following week it was used for 5 minutes. Since February, the patient has had four radium treatments of 5 minutes each, with 4 to 8 week intervals between exposures. The opacity has practically disappeared, and the vision is now 20/20.

These two cases only confirm the work of Lane and others, in that radium does have a very beneficial action on corneal scars, causing them to diminish in size.

During the past six years, we have been treating dense corneal opacities — leucomas — in the children at the Texas School for the Blind, with Wiener's operation and radium. The results have been most gratifying in these hitherto hopeless cases.

We made a preliminary report of this work in 1930, at the meeting of the Southern Medical Society in Louisville. This last May, after 5 years of work, an additional report was made before the Ophthalmological Section of the Texas State Medical Association at Fort Worth.

I shall describe briefly the surgical procedure followed in these cases, by quoting from our preliminary report.

"Under cocaine anaesthesia, a crucial incision was made through the scar with a small scalpel, the incision extending almost to the margin of the cornea, both vertically and horizontally. The incision was made as deep in the cornea as possible without penetrating through into the anterior chamber. The apex of one of the quadrants was then lifted up with a small iris hook (so-called dural hook), and with the scalpel, carefully dissected back toward the base of the triangle, great care being taken to keep in the same corneal layer as that in which we started. This is very readily

done, as the line of cleavage between the corneal layers can easily be seen when making traction on the segment. The dissection is started by making traction with the hook until enough has been loosened to enable one to grasp firmly with a fixation forcep. As soon as the segment is dissected to the base of the triangle, it is cut off from its attachment. In a similar manner, each of the remaining three segments is resected, thus freeing the cornea of its scar tissue. The after treatment is simple. Atropine is instilled, a small quantity of xeroform powder dusted over the denuded area, and a dry gauze dressing applied."

In about 10 days to 2 weeks after the operation radium therapy is started. A 10 mg. platinum needle is used. The lids are held apart and protected with a Ziegler chromium steel lid retractor. The radium is applied by passing the needle slowly to and fro 2 mm. above the cornea. The first exposure is made for 3 minutes, the second for 4 minutes, and the third for 5 minutes. The interval between the sittings is one week. Then the interval is lengthened to every three or four weeks during a period extending over several months, when another operation is performed. We know that scar tissue is sensitive to irradiation, the more recent the scar, the more radio-sensitive it is. After each operation, radium exposures are resumed as described above.

Quoting again from our report of 1930, "There are two points that are of the utmost importance in the treatment of these cases of corneal opacities, (1) by literally shaving off as much scar tissue as possible, the opacity is thinned because the corneal epithelium regenerates more rapidly than does scar tissue; and (2) the gross removal of the tissues prevents the cells from becoming radio-resistant due to repeated radium treatment."

The following cases are taken from our report made at Fort Worth this last May. This work will appear at a later date in the *Texas State Journal of Medicine*.

Case 1. A. J. B., aged 7, entered the Texas School for the Blind in 1927. He gave a history of serious inflammation of both eyes soon after birth. When about 2 years old, Dr. Carey of Dallas, did an iridectomy on each eye, which was quite successful.

Examination: Vision in O.D. was counting fingers at 1 foot and in O.S. at 18 inches. There was a marked lateral nystagmus.

The right eye presented a large central opacity involving two-thirds of the cornea, also a staphyloma. The iridectomy was at 12 o'clock.

The fundus was not seen. The left eye was quite similar to the right, except the staphyloma was not so prominent and the opacity involved a larger area of the cornea.

Two scaling operations were performed on the right eye. These were followed by radium applied according to the previously described technique. The total dosage to the right eye was 9 mg. hours.

The right eye has cleared remarkably in the upper quadrant, the cornea is normal, the staphyloma about one-third its original size. The leucoma is thinner and smaller. The pupil is visible. Vision on April 28, 1933, was 10/200.

The left eye required four operations. The total radium dosage was 20.8 mg. hours. The left cornea has resumed its normal shape. The leucoma is less dense and extensive. Vision on the above date was 4/200.

Result: Exceptionally good.

Case 4. William E. A., aged 37, was a student in the Texas School for the Blind some 20 years ago. He had a history of sore eyes soon after birth. While he was a student in the Blind School, the senior author performed an iridectomy on the left eye, which gave him enough vision to get around unassisted. Treatment was started in 1929, at which time the vision in the right eye was light perception and in the left 2/200.

Examination: O.D. Atrophi bulbi, with a large central opacity and anterior synechia is present. There is a small area of clear cornea between 7 and 11 o'clock.

O.S. The cornea has a large central leucoma, quite dense, involving two-thirds of the surface. The anterior chamber is fairly good, although the iris is bound down anteriorly. There is a coloboma of the iris at 6 o'clock.

This patient had five operations and received a total of 19.16 mg. hours of radium on the right eye.

"On April 23, 1933, the scar tissue of the right cornea was found to be much less on the temporal side. The vision had improved to hand movements at 4 feet."

The left eye had two operations and received a total of 20.66 mg. hours of radium.

On the above date, the "central part of the cornea has cleared to the extent that the dark pupil can be seen. Vision was 8/200 at this time."

Result: Very marked improvement.

The last condition I wish to discuss is that of post-operative recurrent pterygia. In Texas, where the sun is hot and there is much glare, as well as a constant breeze associated with sand and dust, our farmers and ranchmen are quite prone to develop bilateral pterygia. One of us (H. L. H.) has had more experience than the junior author with these cases. He has seen many recurrences, in his own and in those operated on by other ophthalmologists. He attributes these recurrences to the fact that the patients return to their work in the heat and dust too early after operation, or

that they are just naturally more susceptible to recurrence.

Two years ago, we started following up our operative cases with small doses of radium, beginning two weeks after operation. We have noticed that the pterygium not only fails to return, but the patient is relieved of that burning sensation which so frequently accompanies pterygia.

We have also treated a small number of pterygia that have returned following operation, with good results. The procedure is the same as that outlined above. The results have been satisfactory. They have strengthened our belief that beneficial results can be obtained from fractional doses of radium without deleterious effects.

Conclusions

During the past five years, we have used radium with beneficial effect in four conditions of the cornea as follows:

- (1) trachoma with severe pannus and staphyloma.
- (2) maculae and opacities of the cornea.
- (3) extensive leucomas of the cornea, combined with surgery.
- (4) and finally in post-operative recurrent pterygia.

Our dosages have been small and continued over rather long periods of time. The end results have been satisfactory in our hands.

108 West 7th Street.

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Discussion

Dr. Laura A. Lane, (Minneapolis): It gives me pleasure to be here today and speak a word of encouragement to the Drs. Hilgartner, who have added a fine piece of original work to medical knowledge. This work gives definite promise of help to many unfortunate blind people. A little sight is a great asset for these patients and we welcome any measure which will give it.

Rucker has shown that the cornea has power to regenerate. Radium stimulates the corneal cells to regenerate in ulcers of the cornea and has a pronounced effect in clearing opacities of the cornea. This clearing can be definitely followed with the slit-lamp.

I have tried the scaling operation experimentally on the animal cornea and find the corneal layers can be easily split. According to Drs. Hilgartner infections do not follow this operation which is another desirable feature of their method.

In trachoma I have found radium a most satisfactory form of treatment. Secretion is lessened almost from the first treatment, the pannus clears, the conjunctiva becomes healthy and vision improves.

I would like to ask Drs. Hilgartner if the mercury application given so near to the time of the radium does not stimulate a rather free secretion. Heavy metals tend to increase radium reactions.

Radium is a most useful adjunct in treating pterygiums. Much is gained by its use after every pterygium operation. Many cases will entirely clear and disappear under radium therapy without operation. I have a patient under treatment at the present time with bilateral pterygia. The more extensive growth has encroached on the cornea to the pupil margin. The vision was 6/12 minus three letters. 16 days after beginning treatment with radium the vision had risen to 6/7 plus one letter; the growth has diminished half in size and the cornea was much more normal under the slit-lamp.

It is necessary to understand the physics of radium as well as the anatomy of the eye to get results.

Dr. W. F. Moncreiff, (Chicago): In regard to trachoma, radium should be a useful adjunct to the older standard therapeutic measures, because of its obliterative effect upon the smaller blood vessels, and also by reason of the regression of follicles and granules (lymphoid tissue), as well as the thinning of scar tissue, which occurs following its use. Radium should thus be our most valuable weapon against the trachomatous pannus, once it has developed, and by its action on the conjunctival lesions should materially shorten the course of the disease in a considerable proportion of the cases. It is perhaps regrettable that no cases of early or moderately advanced trachoma were included in this report, so that these points might have been better illustrated.

The postoperative application of radium in pterygia, and its use in recurrences after operation, is of the greatest interest and importance. The more vascular the type of pterygium, the greater the probability of postoperative recurrence. Many of these recurrences are more severe than the original condition, and with repeated operations the situation only becomes worse. In the Chicago district, this type of pterygium is seldom seen except in Mexicans, Filipinos, Chinese and other orientals, who possibly have a predisposition due to racial or previous environmental factors.

The results obtained by the essayists in dealing with dense and extensive corneal leucomata by non-penetrating excisions followed by radium therapy are so markedly superior to those obtained by any of the methods of keratoplasty or corneal transplantation that it would seem that the time has arrived when these last mentioned methods should be discarded. For the benefit of any who may be insufficiently familiar with the use of radium, it might be desirable to have a more complete description of the details of the radium technic employed by the authors. Their principle of small dosage repeated many times at suitable intervals over a long period of time is undoubtedly correct, yet one feels that a moderate increase of the dosage might, without exceeding perfectly safe limits, give even better results.

Dr. A. James Larkin, (Chicago): In the radium treatment of advanced trachoma using 1 mm. of copper as a screen and with the exposure made through the eyelid, the results would be reduced inasmuch as 50 per cent of the emitted beta rays would be absorbed before reaching the conjunctiva. On the other hand 10 mg. hrs. of unscreened radiation at 2 mm. distance from the conjunctival side even if extended over a long period of time would be much more apt to show

results. When unscreened radium is used, the number of rays reaching the lens would be negligible while keeping the conjunctival reactions within the desired limits. Cataracts are rare following radiation with radium and rarer still as a result thereof.

The use of a 10 mg. radium needle in dense corneal opacities at 2 mm. distance beginning with 3 minute and increasing to 5 minute exposures would seem to be safe procedure. Further increase of dosage with platinum screen would be justifiable.

The radium treatment of pterygium is gratifying. The reasonableness of the method and the expectancy of good results in other fields where ulcers are healed and scar tissue formation prevented furnish encouragement. Immediate radiation is advised rather than waiting ten days, post-operative.

Dr. H. L. Hilgartner, Jr. (closing): Dr. Moncreiff asked about trachoma. We see relatively little trachoma in our section. Most of the cases are old cases that come from a distance.

I have recently seen several cases of bilateral pterygium on the same eye. They were rather interesting because they were relatively rare. All of the cases were in negroes.

As far as the radium technic is concerned, just take a 10 milligram platinum needle and pass it back and forth. The lids are held open by either a lid retractor with the help of an assistant or a retractor that has a spring in it.

In regard to mercury and radium being used rather closely together, we have not found that it causes any noticeable change in the eye. In cases of dense corneal leukomas, we can use radium over a long period of time without any danger of cataract, because in most of the cases the lens is opaque in the center anyhow, due to the adhesion between the cornea and the lens.

HYDROTHERAPY IN ARTHRITIS *

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Water as a therapeutic agent has been in use since the earliest days. Its employment in the treatment of arthritis has extended over many centuries and while in the past it was applied largely empirically, more recently efforts to establish it on a scientific basis have been attended with a definite measure of recognition. As our knowledge concerning the

causes and treatment of arthritis has been augmented, the indications for the use of hydrotherapy in the treatment of these patients have become increasingly evident and today it is pretty generally agreed that no well organized therapeutic attack upon a case of arthritis is complete unless suitable provision has been made for the employment of hydrotherapy.

While the present day concept of chronic arthritis lacks verification at many points, cer-

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 14, 1933.
* From the Department for the Study of Arthritis of the Levi Memorial Hospital, Hot Springs, Arkansas.

tain basic elements in our knowledge of this disease seem definitely established. We accept the existence of two main types, the atrophic and the hypertrophic. The importance in the treatment, of eradicating active foci of infection, combating the effects of bacterial intoxication with specific or non-specific means, correcting errors in diet, regulating elimination, etc., are factors generally agreed upon. Circulatory disturbances, particularly in the capillaries, whether primary or secondary, are undoubtedly closely related to the pathological disturbances within the joint, and general vascular instability due to muscular inactivity undoubtedly plays an important part in aggravating the disturbance. Combating these circulatory changes and the symptoms arising therefrom is one of the main requirements of successful treatment for arthritis, and it is believed that properly applied hydrotherapy is a most effective means of initiating these beneficial changes.

Perhaps much of the disrepute from which hydrotherapy has suffered in the past has been due to the haphazard manner in which it is employed in unskilled hands. Lending itself readily to rather widespread application in athletic clubs, massage parlors, Turkish and Russian baths and even by the patient himself in his home, lack of appreciation of the physiological and pathological effects of the treatment frequently not only results in failure to obtain benefit but actually in definite harm. In this regard hydrotherapy is not unlike some of our most popular drugs, whose beneficial action depends largely upon the skill and supervision with which they are administered, lack of which may cause serious harm.

General Considerations

The prevailing impression that hydrotherapy and hot baths are synonymous has undoubtedly resulted in damage to many arthritic patients. Fortified with the instructions that "hot baths will be beneficial" the patient goes home and lies as long as he can in a tub of water which is as hot as he can bear. He emerges from the ordeal weak and exhausted and minus some of the energy which is so necessary to conserve in the treatment of his condition. Most arthritics, whether of the atrophic or hypertrophic type are asthenic, inactive individuals with blood

pressure below normal who do not tolerate over-exposure to heat.

The temperature at which water produces the least effect upon the body is 93 degrees F.; this is termed the point of thermal indifference. Thermal baths—that is those between 97 degrees and 102 degrees are most frequently used in the treatment of arthritis, while hyperthermal baths are apt to produce discomfort and exhaustion. In general, the duration and temperature of the bath may be gauged by the patient's blood pressure. The immersion bath, being only a preliminary part of the treatment, should not be too strenuous. A tub bath at 97 degrees F. for 10 minutes is suitable for a patient with low blood pressure, while a patient whose pressure is more nearly normal will tolerate 102 degrees for 20 minutes without discomfort. Patients should drink liberal quantities of water before and during the treatment and provision should be made for the gradual cooling off of the patient. The temperature of the bath room should be maintained at about 100 degrees.

Hydrotherapeutic Procedure

Immersion Baths. The tub should be large enough to enable the patient freedom of motion and if necessary a board may be placed at one end so that he can brace himself. The tub should be well filled with water at the prescribed temperature and after the patient has been immersed, an attendant should apply brisk friction and massage to the entire body.

Heat produces dilatation of the superficial veins and a secondary stasis of the peripheral circulation which impedes the interchange of blood in the deep capillaries. The underwater friction and massage tend to accelerate the peripheral circulation and promote capillary interchange in the deeper structures. While still in the tub, the patient should be encouraged to exercise all of his joints as much as possible. Joints in which voluntary motion is impaired should be assisted by the attendant. Gentleness and the avoidance of forced motion and pain are necessary requisites in correctly applied passive motion in these cases.

Douches and Sprays. Douches and sprays are used largely for their counterirritative action and permit the localized application of water to affected joints at temperatures which could not be tolerated by the entire body. Many of the European spas employ the

douche principle to modalities adapted to their own ideas and the alternating hot and cold douche has many proponents in this country as well as abroad. As far as arthritis is concerned the simple hot douche is decidedly better tolerated and produces a much more lasting hyperemia than when alternated with the cold. The simplest way of applying the hot douche is to attach a short hose to the faucet, and after permitting the water to drain from the tub, directing the flow of water, with only moderate force, on the affected joints at a temperature as hot as the patient can tolerate for from three to five minutes.

Steam Cabinets and Steam Rooms. These are used to promote sweating and elimination through the skin. In most instances, steam is applied by permitting the patient to lie for ten to twenty minutes in a room filled with steam. The temperature of this room is frequently 115 to 120 degrees F. In arthritis the steam cabinet with the head out is much to be preferred, because it is much less depleting to the patient. In this cabinet the patient sits on a stool with the head protruding through an opening in the top. Towels are placed around his neck to prevent steam from escaping and cool cloths may be placed on the patient's head. Live steam is permitted to enter the cabinet, the temperature of which should not exceed 110 degrees. Five minutes in the steam cabinet is all that most patients can comfortably stand, the optimum duration of the treatment being perhaps one to three minutes.

Hot Packs. These are given for their local counter-irritant action on affected joints. The temperature of the pack room should be about 105 degrees, and heavy Turkish towels wrung out of hot water should be applied as hot as the patient can stand them. It is well in most cases to apply, in addition, a hot pack over the kidney region. The packs are allowed to remain for from ten to twenty minutes, the patient being covered with a sheet or blanket. As the packs cool off additional hot water may be poured on them as required.

Therapeutic Pool. Treatment in the therapeutic pool is indicated in cases of arthritis with muscular atrophy from disuse. The pool should be large enough to accommodate the patient and attendant and permit a few swimming strokes. A table stands in the pool submerged to a depth of about 8 inches, so that

when the patient lies on the table he is buoyed up slightly by the water. Patients who are helpless are placed in a sling or hammock which operates on pulleys and are slid into the pool. The temperature of the water should be about 100, with the room temperature at 90 degrees F.

Passive motion is applied to inactive joints. The patient is taught how to exercise atrophied muscle groups. Once voluntary motion has been reestablished, supervised exercises in the pool are practiced by the patient. Great care must be taken to avoid pain and over fatigue.

Physiological Action

Hydrotherapy exerts its beneficial action in arthritis by virtue of two main properties; namely, thermal and physical. The chief effects of the thermal action are:

1. Vaso-dilatation.
2. Relief of pain and muscular spasm.
3. Pyrexial action analagous to protein shock therapy.
4. Diaphoresis and diuresis.

The close relationship which diminished circulation in the capillaries bears to arthritis has been stressed by many observers. It is believed that some constitutional deficiency possibly hereditary in nature, is responsible for the poor capillary circulation and that this condition favors the deposit of infectious material from foci of infection which induce destructive changes in the joint tissues. It seems likely that the acceleration of the general circulation and dilatation of the capillaries which is induced by heat is one of the most fundamentally curative measures in the treatment of arthritis.

Relief of pain and muscular spasm is an important consideration. Muscular inactivity due to pain tends to increase atrophy of the muscles and joint tissues, which in turn leads to increased pain and decreased motility in the joints. The analgesic action of heat with the resultant relief of muscle spasm helps to break this vicious circle. The psychological effect on the patient of even a little motion in a previously stiffened joint is often sufficient to encourage him to added effort and increased optimism.

A pyrexial reaction is frequently noted in patients as a result of properly applied hydrotherapy. The elevation of body temperature

is believed to be similar in nature to that induced by protein shock. Increase in temperature of from one to three degrees Fahrenheit has been observed following the treatment, with a gradual return to normal over a period of three to five hours. Coincident with the rise in body temperature there is noted an increase in leucocytes and in their phagocytic power. There also occurs an increase in the metabolic rate. A slight exacerbation of the joint pains is commonly noted during or following the febrile period such as usually accompanies foreign protein injections. While the manifestations of protein shock are but imperfectly understood, it is believed that they represent increased activity of forces concerned with eradication of body poisons. The value of introducing such an element in the treatment of arthritis becomes clinically evident in most cases.

Increased elimination of water through the skin and kidneys induced by hydrotherapy is a generally recognized feature of the treatment. No facts are available to indicate that the sweating process is accompanied by increased elimination of toxins specifically related to arthritis although the removal of waste products in general undoubtedly takes place. Diuresis results partly from the accelerated general and capillary circulation in the kidneys and partly from the copious intake of water which accompanies the treatment. As with the diaphoretic action, the increased elimination of waste products through the kidneys while perhaps not specifically related to the arthritic process, nevertheless represents the removal of a large and important element from the great toxic burden which these patients carry.

The physical effects produced by hydrotherapy are mainly counter-irritative and supportive. The counter-irritant action may be induced by a number of different modalities by which water may be applied, such as douches, sprays, packs, etc. They serve to induce local hyperemia in the soft tissues related to the affected joints and undoubtedly play a large part in restoring impaired circulation and function. The supportive effects may be obtained by placing the patient in the so-called "therapeutic pool," a large bath tub well filled with water making a good sub-

stitute. The supportive or "buoyant" action of the water has been invoked in the treatment of arthritis at most European spas for many years. In this country interest in this phase of hydrotherapy has been aroused in the past few years by its favorable effects in muscular atrophy due to infantile paralysis. The application of this principle in the treatment of arthritis has proven very effective in the reeducation of muscles atrophied from disuse. It is astonishing to see patients who are practically helpless under ordinary conditions walking and swimming in the pool.

Comment

While comparatively little is known concerning the heat regulating mechanism of the body, it is apparent that subjecting any individual to an abnormal degree of heat without providing for proper radiation is not innocuous. In particular, the unstable circulation which is characteristic in chronic arthritis does not seem to tolerate excessive heat. In these days when baking in the sun, lamps and heating appliances, diathermy and fever therapy are indiscriminately recommended and employed in these cases, it seems opportune to sound a note of warning and ask ourselves if exposing these patients to excessive temperatures is entirely without untoward effects. It is my belief that a sustained moderate degree of heat is tolerated much better than a higher degree of heat of shorter duration. It is my further belief that moist heat in chronic arthritis offers a factor of safety against over-heating by furnishing a means of heat radiation. In this manner hydrotherapy offers a means of applying heat with a minimum of physical depletion and circulatory depression.

Summary

1. Hydrotherapy is of definitely curative value in arthritis.
2. When properly applied it has an accelerating action on the capillary circulation which is of fundamental benefit.
3. It furnishes a means of applying heat to the body without inducing thermal debility.
4. It permits by its analgesic and supportive action increased motion in affected joints and inspires the patient with added confidence and courage.

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EDITORIALS

ANHELIOSIS AS A PUBLIC HEALTH PROBLEM

Anheliosis is the status of individuals suffering from periodic or seasonal deficiencies of sun radiation and has more recently come to be recognized as the most provocative factor of the many ailments of fall and winter seasons. Under the above term Professor Lonne, of Gelsenkirchen, calls attention to the condition of workers in industrial areas, particularly those in mine districts, distinguishable by their pallor and haggard appearance. According to Lonne anheliosis produces constitutional and mental reactions which manifest themselves as seasonal sickness during that time when sunshine apparently is at lowest reception in our environment.

Since change of environment is obviously an impossible prescription for people of middle class, wage earners or their families, substitute methods of treatment were essential to provide the necessary defense against this condition. The work of Rost, Bach, Peemoeller, Maughan and Smiley, Wood and others, provided the data regarding the value of artificial ultraviolet generators to prevent, protect and relieve the many symptoms associated with periodic sun starvation. Individuals so treated have been noted to experience a general euphoric state, with re-

sultant improvement in both mental and physical symptoms. People deprived of sunshine because of indoor occupations may now obtain adequate ultraviolet radiation to protect them against inclement seasons and consequent sickness. Indeed the treatment of these classes, studied in control groups, shows not only added efficiency absent in the control series, but also a reduction in total and partial disabilities.

Reports from the Sherwood Colliery in England demonstrate the practical significance of the artificial irradiation of workers. Young miners were irradiated with the Alpine sun lamps twice a week for three months, with results that favorably compared with those obtained during a systematic study of the effects of light and air in the Swiss Alps.

At the Kaiser Wilhelm Institute, Lahmann and Szakall have made exact physiological studies on a number of persons. All of the subjects were kept under observation for six months with an exact record of their individual ultraviolet treatments. It was found that not only was the tone of the skin visibly improved, but gradual metabolic changes occurred, such as one notes in athletes during training. A lymphocytosis was observed with a shift in the differential count toward the polymorphonuclears — the total leucocyte

count remaining stationary. The tone of the muscles was notably improved, so that, after irradiation, the same work could be performed with less evidence of fatigue. The amino-acids liberated through the effect of muscular activity were more quickly removed and the alkali reserve of the system increased. In other words, the recovery period following muscular work was considerably shortened by means of artificial ultraviolet irradiation.

To compensate for the sun-starvation found in many of our industrial and medical centers, artificial irradiation has been provided for many of these employees, either in the form of group treatment at the factories and other sites, or arrangement made with industrial physicians for the individual patient. Recently the Guy's hospital, of London, introduced artificial sun baths for night workers and especially for nurses on night duty. Tri-weekly irradiations with mercury in quartz generators were given and the beneficial results were so pronounced as to have encouraged this practice in other fields. Similar practices have gradually come to be regarded as a health necessity in the theatrical industries, as well as other centers where the health index of the individual is at highest premium.

For the protection of the school and crippled children artificial irradiation has proven an investment of great value. At the Spaulding School for crippled children, Goldberg introduced special ultraviolet units which, operating in connection with an esculator arrangement, carry the patient in front of these lamps in a certain unit of time. Mass treatment with minimum discomfort of these handicapped patients was attained. This innovation has made it possible to offer irradiation benefits so standardized and precise as to insure constancy of such variables as distance, time, and intensity. By means of this apparatus and the benefits already accomplished, Goldberg has pointed the way for the general adoption of similar units in other needed centers. The timely use of artificial irradiation has come to be regarded as a specific against anheliosis and a prophylactic against the many affections resulting from sun starvation. Irradiation for health should be the slogan of the physician, rather than the beautician.

WHAT PRICE FOLLY?

Of all professions none suffers as much from an inadequate livelihood as that of Medicine. The fault lies not entirely with an unappreciative and ungrateful clientele but to a great extent with the medical profession as a body politic. Nor is such a state of affairs limited to our country, the existing evil being virtually identical in nature throughout the civilized world. Add to this the present world-wide depression and we have effects which drive even those who heretofore have preferred dignified silence and patient forbearance to "speak out in meeting." Certainly the time has come when medical men, and particularly those who are specially interested in physical medicine, should take advantage of whatever measures that promise an amelioration if not a cure of our common ill.

It would seem that medicine has since time immemorial been a calling which shared its sphere of activity with men and women who had no justification to treat human ills, other than a pretense at familiarity with sicknesses and their treatment. There was no help for it during that stage of transition when the cure of disease was passing from the hands of the priestcraft to professional physicians. There was no help for it when Academic Medicine considered surgery to be too menial to be practiced by any other than barbers, but — mark this — under its supervision. But with the development of General and Special Medicine and Surgery to a science too vast in scope to be mastered in a lifetime by any one man, no matter how gifted, it would seem that laymen would not dare dabble in diagnosing and treating human ailments — but they do. Of such men — and women — we have enough in number to challenge the forces of organized medicine.

The human instinct to help a fellow man in physical or mental distress is a noble trait. We do not oppose but would rather encourage world-wide training in First Aid, such as has been initiated by the various Red Cross and other philanthropic organizations of the world. What we are opposed to is the constant multiplication of self-appointed medical sects who without adequate training or without any training at all are infesting the world for the sole purpose of gaining an easy and comfortable livelihood without responsibility or effort on their part.

In the civilized world the states have im-

posed on the regular medical schools demands insuring thorough theoretical and clinical grounding of students before conferring upon them the academic dignity of a Doctor of Medicine. The reason the diverse governments made such demands was to protect the public. It would seem, therefore, that these same governments would restrict the practice of medicine to duly graduated and state-licensed physicians, but as a matter of fact in many countries, including the United States, there are many backdoors by which men and women can ply a trade of "healing" in a manner no sane citizen would allow his watch to be repaired.

In Germany, once regarded as the very fountain of scientific medicine, it was due to the caprice of the powerful "Iron Chancellor," Prince Bismarck, whose edict made it possible for every tailor, shoemaker, shepherd, nay, even felon to treat human ills. Any one could hang out his shingle as a "Naturheilkundiger" (one versed in natural healing) or "Magnetopath" (magnetic healer) and treat patients. We have almost lived down in our country the sad facts that alongside of so-called regular schools of medicine there were organized a considerable number of homeopathic, eclectic and botanical (Thompsonian) schools, chartered by states and empowered to grant the degree of Doctor of Medicine, which in many states sufficed for licensure. Sun-down schools, too, did not add to efficiency, but as long as the young graduates were within our fold, professional ambition in countless instances made good the evils of insufficient training and control. There always have been and there probably always will be charlatans, unscrupulous, lazy, and incompetent men in our profession, but we have the means of keeping them at arms length.

What is amazing and disheartening is that almost all our legislators have listened to the alluring voices of claimants to special medical skill and have granted charters to osteopaths, naprapaths, chiropractors, and like species. But the fault was ours. We felt ourselves too entrenched in the conviction that the public is intelligent enough to separate the wheat from the chaff, but we find day in day out that brazen effrontery and loud mouthings secure audiences much readier than truth. We believed that men elected as the peoples representatives and law makers would be sagacious enough to appreciate that scientific med-

icine is broad enough to satisfy all the needs of suffering humanity within the limits of human power, but we learned that politics has never taken science as a bedfellow. The argument has always been that as long as men and women without adequate medical education are forbidden to prescribe poisonous drugs and perform surgical operations, the interests of the public are safeguarded. No one was there to enlighten our solons that legitimate physicians have need of a much greater armamentarium than medicinal prescriptions and surgical operations, equally potent for good or harm. No one was there to tell them that because a sectarian practitioner of pseudo-medicine is forbidden to perform operations, he will certainly avoid advising such a procedure as long as possible and thereby be responsible for avoidable fatalities.

We who are cultivating the beneficial uses of physical therapeutic measures are confronted by a particularly distressing situation. Of what avail is to us the prolonged study of light, diathermy, hydrotherapy, etc., when every man or woman who has learned to turn on a few switches can open offices, nay, veritable clinics separate or in connection with massage and beauty parlors. Common domestics or worse have been known to suddenly crop out as "physiotherapists" and instead of scrubbing floors, directing their chauffeurs to take them to their "consultation" rooms. Even colonic irrigations are performed by women of questionable character at so much per splash.

We have paid a terrific price for our folly of a dignified *laissez-faire* policy. More than one-half of our clientele who should contribute to our livelihood have been lured from us by methods with which we are forbidden to compete. Organized medicine must find the proper remedy for such ills. We have brains enough and political power enough as a body politic to force our law makers to listen to reason.

The American Congress of Physical Therapy hopes to make a beginning by organizing our technicians with a view of placing them under proper medical supervision. But that is only one skirmish in a war of magnitude that can result in only a limited gain of terrain. To win the war the whole medical profession must throw itself into the struggle wholeheartedly, if it desires to come into its own.

NEW MEMBERSHIP DRIVE TWO HUNDRED NEW MEMBERS FOR 1934

As this issue goes to press, plans are being perfected for a vigorous membership drive which should add 200 new members to the Congress roster for 1934. The need for an increased membership is quite obvious. The Congress must have added strength and a larger membership roll will mean greater organization influence.

It is not a difficult task to acquire 200 new members providing we have the complete co-operation of those active in the organization. In fact if every member would sign up one new applicant the increased membership in the Congress would far exceed our present quota.

There are any number of physicians in the United States who are doing some physical therapy in their practice. These men should be affiliated with a national organization which is endeavoring to promote scientific physical therapy. It will aid these men materially because of the propaganda carried on by the Congress to take physical therapy out of the grasp of the charlatan and the quack.

The Congress through its regional bodies is putting on an educational campaign which will bring to physicians and technicians instructive programs closer to their own localities. In this connection attention is directed to the Eastern spring meeting which will be held in New York, the Mid-Western meeting which will be held in Indianapolis, and the Western meeting which will be conducted in Los Angeles, California. These spring meetings are an innovation, but their success last year warrants a continuance of this same plan during 1934.

The Congress offers many inducements for membership, among which can be mentioned instructional and scientific programs, educational propaganda, and a monthly journal which ranks as the best in the field. The fellowship in this organization is in itself an inducing feature, and this can be vouched for by those who have been affiliated with the Congress since its origin. The Congress will gladly aid in the organization of local bodies and is in a position to furnish lecturers of outstanding reputation for the presentation of the advances in the newer science.

If for any reason you have not been furnished application blanks, please write to the central office. Make it your duty to secure

at least one, and if possible, several new applicants. This campaign must be a success, and again we repeat, we need this added strength. Will you cooperate?

Correspondence

On Priority of Electropyreto-therapy

To the Editor:—In an article appearing in the November issue of the ARCHIVES OF PHYSICAL THERAPY, X-RAY AND RADIUM, entitled "The Progress of Physical Therapy," by Albert F. Tyler, the following statement appears: "J. Cash King and Edwin W. Cocke first used the high frequency electric current for producing fever in a patient suffering from paresis, in October, 1928. . . . Since then this method of producing hyperpyrexia has been widely adopted, and the favorable results reported above have been widely confirmed by Neymann, Osborne and others."

We have become rather impatient of pointing out the facts of our priority to some of our confreres, who evidently are neither in close contact with the situation nor with the literature, and whose references to this literature are purely conjectural. In this particular instance, it is especially to be regretted that gross errors have crept into the presidential address of a society of high scientific repute.

Whenever priority is claimed by anyone, this priority must be substantiated by the literature. The first publication that ever appeared in any literature about electropyrexia was a report by Neymann and Osborne entitled "Artificial Fever Produced by High Frequency Currents." This was published in the *Illinois Medical Journal*, September, 1929. It comprises work that had been in preparation since the early part of 1927. This was published two months before King and Cocke made their report to the Southern Medical Association, and seven months before their article was published. Our article was ready for publication in March of 1929. Its publication was purposely delayed for several months because we wished to include more human experiments, and particularly more results of treatment that we believed were conservatively available at that time. For this reason our first report was entitled "Preliminary Report." The later comprehensive report on the treatment of general paresis, read before the *A. M. A.* in June, 1930, and published in the *Journal of the A. M. A.* January 3rd, 1931, was a continuation of this preliminary report. In our preliminary report we reproduced a fever curve of a patient suffering from general paresis treated by our method. It is well known to us who suggested diathermy as a method for hyperpyrexia to the profession at large, after this individual had watched our animal and human experiments, and before we were ready or willing to make any statement.

We must, therefore, ask Dr. Tyler to be guided by a scientific perusal of the literature and not by

hearsay or suggestions in speaking of priority. Our priority is established by the literature. Our early methods were not based on the researches of other individuals. It is not our custom to follow in the footsteps of others, but rather to investigate our own scientific problems.

Very sincerely yours,
(Signed) CLARENCE A. NEYMANN.
S. L. OSBORNE.

This Status of Priority

To the Editor:—I appreciate Dr. Neymann and Mr. Osborne calling to my attention that part of my address relating to the priority of electropyrotherapy. I assure both that the impression set down was not a question of careless rhetoric but prompted by information which appeared authentic. My definition of the meaning of priority is perhaps broader than that interpreted by the above complainants. It goes back beyond the record of mere publication. A classical case in point that perhaps parallels the present situation is that of Darwin and Wallace in the connection with the Theory of Evolution and the Origin of Species. Independent of each other the younger Wallace arrived at his preparatory stage of publication long before Darwin, although the latter had already formulated and checked and re-checked his theory for twenty years. The spirit of fair play and good sportsmanship was responsible for clearing the title to priority in favor of Darwin, and to the credit of Wallace. This is an example that may have no actual or factual counterpart in the issue at hand, but I cannot refrain from suspecting that the dignified silence of King and Cocke is anything but a tacit acknowledgment of their negation to priority claim. Indeed the issue at hand is not so much the priority of publication but the priority of original work. This should be the fundamental issue, if issue it is at all worth while making. According to sources that to my mind are reliable and authentic I have gained more than a rhetorical impression that King and Cocke were the first workers to actually demonstrate the effect of electropyrotherapy by means of diathermy upon human material in 1928. The spirit of fair play suggests that we hear the claims of King and Cocke before acknowledging our error.

Yours truly,
ALBERT F. TYLER.

Claim for Originality

To the Editor:—We do not consider it our privilege to state upon what grounds priority may be claimed or established by anyone in work of this nature, but we do unhesitatingly state that our work and the thoughts that stimulated us to attempt this work were entirely original with us and independent of anyone else. We wish to submit the following facts and let those interested in the subject arrive at their own conclusions as to who deserves priority.

The idea of attempting to produce an elevation of the general body temperature for therapeutic

purposes came to one of us (King) after reading an abstract of a paper by Mendel which appeared in the May 19, 1928, issue of the Journal of the American Medical Association. The subject of this abstract was "Sensitiveness of the Cancer Cells to Heat." Mendel's studies were made with fever produced by the application of hot baths and the subsequent use of the "pack" and sodium chloride. It occurred to King that if fever could be produced with diathermy, it could be more easily controlled and might be less exhausting to the patient. With the aid of Mr. H. D. Roop and through the courtesy of Dr. Vischer* we began work on dogs at the Department of Physiology at the University of Tennessee in the early part of June. Although we were able to raise the general body temperature of dogs, they proved to be poor subjects for this problem. Too, a perusal of the literature revealed that this line of investigation had already been worked out thoroughly and completely by Binger and Christy of the Rockefeller Institute. However, we continued our work on animals until October 1, 1928.

On the night of October 22, 1928, one of us (King) applied the treatment to a negro man, J. K., (a case of paresis) who was a patient at the Memphis General Hospital. A temperature of 103.8 degrees F. was produced. The equipment consisted of large lead foil electrodes applied to the front and back of the thorax, a standard type of Vario Frequency Diathermy Machine, rubber sheets and heavy woolen blankets, the latter serving as insulation of the patient against dissipation of the heat. In the second treatment to this patient, given on October 24, 1928, the temperature was raised to 105.2 degrees F. After that date the treatment was continued at irregular intervals on parietic patients at the Memphis General Hospital and the Shelby County Hospital. In the latter part of January, 1929, this work was transferred to the Western State Hospital, Bolivar, Tennessee.

It was about this time that we were asked if Dr. Neymann and Mr. Osborne (the latter at that time employed by the Victor X-Ray Corporation) might visit us and observe the application of this new form of therapy. Dr. Neymann did not fulfill his engagement, but Mr. Osborne did come to Memphis and observed our work. At that time he did not make any mention of having done work along this line and left the impression that he was very much interested in this new form of therapy, which was original with us.

In a letter from Dr. Neymann to Dr. King dated April 1, 1929, he stated that "the whole matter (fever therapy) at present seemed very problematic." He added, "Today using the new electrodes we produced a temperature of 103.4 degrees F. without the slightest burn." In this letter he stated he would be glad to cooperate with us in the work with general paralysis and that publications would be made jointly with the names of himself, Mr. Osborne and Dr. King. Dr. King declined.

He further stated in this same letter "the work Mr. Osborne and I have done up the present

* At that time Professor of Physiology at the University of Tennessee.

time, which does not include the work in general paresis, will, of course, be published separately by us."

After refusing to publish as co-author with the above men, our correspondence with them ceased.

We made no effort to rush into print the description of this means of producing fever because we first wished to ascertain whether or not it had a similar therapeutic effect as fever produced by febrile diseases.

Our first preliminary report entitled "Therapeutic Fever Electrically Produced" was submitted to the Journal of the American Medical Association August 13, 1929. However, the report was not published by the American Medical Association Journal but was rewritten and read under the title "Therapeutic Fever Produced by Diathermy with Special Reference to its Application in the Treat-

ment of Paresis" before the Southern Medical Association November, 1929.

The above statements can be substantiated by records, letters and witnesses.

I would like to submit the names of others who observed our work before our first publication:

Sidney D. Wilgus, M.D.,
State Alienist for Illinois.

R. T. Hinton, M.D.,
Elgin, Illinois.

A. David Willmoth, M.D.,
Louisville, Kentucky.

Mr. Carl Darnell,
General Electric X-Ray Corp.

Respectfully submitted,

(Signed) J. CASH KING,
EDWIN W. COCKE.

Radium Treatment of Inoperable Gastric Cancers

Professor Gosset, in collaboration with Messrs. Monod and Regaud, reported to the Academy the results of using radium *à distance* in thirty-one cases of inoperable gastric cancer. The results were not brilliant. The chief interest of the report lies in the fact that the high reputation of Mr. Gosset justifies the conclusion that others are not likely to succeed better in this field. Mr. Regaud had supplied a relatively large quantity of radium (4 Gm.), which was distributed over a rectangular plate with an area of from 125 to 160 square centimeters, and applied at a distance of 10 cm. from the skin. The rays penetrated through multiple cutaneous surfaces: epigastric, dorsal and laterotransversal. The sittings for irradiation, with a duration of two hours each, were distributed according to series over a total period decided on tentatively in advance but variable in keeping with the tolerance of the patient. In seventeen cases (54 per cent) no improvement was secured. In seven cases the treatment gave some relief but without prolonging life. In seven cases (22 per cent) there was considerable improvement and life was prolonged varying periods of time. Two of these patients are still living; one appears to be cured, after a space of six and a half years. The other patient has sur-

vived four years and nine months. Two factors influenced unfavorably the results: (1) the bad general condition of the patients, who could not endure the dose necessary to bring about a notable retrogression of the cancer; (2) the resistance to radium displayed by the cancerous tissue, the resistance varying greatly in different cancers; it is as yet impossible to determine in advance what the resistance will be, on the basis of the histologic type of the tumor, as there is a lack of documentation in such cases. For the histologic examination to have full value, the tissues must be taken from the tumor itself and not from the perigastric glands, which are often enlarged although not invaded by the cancer. Since the reaction from removal of a fragment of tumor may be dangerous, the most interesting cases to study are the recurrences after gastrectomy, when the portion removed by operation has been carefully examined. Surgical exploration will be supplemented by gastroenterostomy if need be, and by fixation of the stomach to the anterior wall of the abdomen to permit bench-marking of the tumor with reference to a future incision. If a cancer is operable by gastrectomy or pylorotomy, exeresis is preferable to radium therapy, the latter method being reserved for cancers that are actually inextirpable.—J. A. M. A., Foreign Letters, 102:306 (Jan. 27) 1934.

ATTEND MID-WESTERN SESSION
OF
AMERICAN CONGRESS OF PHYSICAL THERAPY
ON
TUESDAY, MARCH 13, 1934, INDIANAPOLIS, IND.
SEE
COMPLETE PROGRAM, PAGE 128

CURRENT NEWS AND SCIENCE

Epitome of Contributions to Science in 1933

(Cont. from page 54, Jan. 1934)

Research indicating that alcoholic cirrhosis may be due not to alcohol from beverages but to phosphorous from the iron and steel beverage containers was reported by Dr. Frank Mallory of Boston.

A premium of 10 per cent in the price of safety x-ray film of cellulose acetate was eliminated by the Eastman Kodak Company as a contribution to the campaign for safety in hospitals.

The exact method by which blow-fly maggots act to clean and heal stubborn wounds was finally discovered by a group of Pittsburgh scientists who observed that the maggots throw out into the wound a secretion having weak digestive action which liquifies the dead and decaying matter.

Shape and size of the brain is often determined by the skull, rather than the reverse, Prof. C. U. Ariens Kappers, Central Dutch Institute for Brain Research, Amsterdam, found.

Vaccination against smallpox was successfully carried out with virus grown on hen eggs instead of with calf-lymph virus by a method developed by Prof. E. W. Goodpasture and associates of Vanderbilt University Medical School.

A "spreading factor" produced in living tissue by invading germs and making it easier for the germs to invade new territory in the tissues was discovered by investigators at the Rockefeller Institute for Medical Research.

Talkie films of patients were found an aid in identifying the nervous disease, disseminated sclerosis, by Miss F. Janvrin working at a London hospital for nervous diseases.

Microcolonies of leprosy bacilli were grown on artificial medium outside the body of man or other animal, it was claimed by Drs. Earl B. McKinley and Elizabeth Verder of George Washington University Medical School.

A serum for protection against tularemia or rabbit fever which apparently reduced the severity of the disease in 72 patients was developed by Dr. Lee Foshay and Prof. W. B. Wherry, University of Cincinnati.

Skill with the fingers, major postural adjustments of the body, and regulation of such involuntary actions as sweating and blood-vessel adjustment were traced to the premotor area of the brain by Prof. J. F. Fulton of Yale University.

Evidence that centers responsible for blood pressure control, heart rate control, breathing control and sweating, shivering, hiccoughing, yawning and other functions of the autonomic nervous system are probably located in the dien-

cephalon or interbrain was found by Prof. Wilder Penfield, McGill University.

Serious deformities of face and teeth may result from idiosyncrasy or sensitivity to certain foods, Dr. Ralph Bowen of Oklahoma City found.

Heat or cold or physical effort may cause headaches, asthma, skin eruptions and other symptoms of allergy in sensitive persons, Dr. W. W. Duke of Kansas City reported. European physicians reported cases of cold allergy which suggest that people with idiosyncrasy to cold are in danger of drowning from bathing in cold water.

Thorium dioxide, new chemical used to diagnose spleen and liver diseases, was found by Drs. Ernest A. Pohle and Gordon Ritchie of the University of Wisconsin to produce such injurious changes in the liver and bone marrow of animals that they recommended restriction of its use to incurable cases.

A new remedy for poisonous potassium cyanide has been developed by Drs. K. K. Chen and G. H. A. Clowes and Charles L. Rose of the Lilly Research Laboratories, the remedy being made up of sodium thiosulphate and amyl or sodium nitrite.

Successful vaccination of over 100 children against whooping cough was reported by Dr. Louis Sauer of Evanston, Ill.

Use of a magnet to isolate certain tissue cells after feeding them iron was reported by Drs. Peyton Rous and J. W. Beard, Rockefeller Institute.

Transposed organs are the result of developmental accidents, Dr. Harold Cummins of Tulane University concluded from a study of the direction of the hair whorl and of palm prints in these rare cases.

Amount of pepsin in stomach juice of patients suffering from stomach ulcer was found to be a good index of the progress and outcome of the disease by Drs. Arnold E. Osterberg and F. R. Vanzant, Mayo Clinic.

Bacteria survived freezing for weeks in liquid helium at a temperature of about 450 degrees below zero F. and were able to multiply after being thawed out.

Foot-and-mouth disease virus may invade the bodies of cattle through the nostrils, experiments at the Rockefeller Institute for Medical Research seemed to show.

That the yellow fever mosquito can transmit a serious epidemic disease of horses and mules, Kansas-Nebraska horse plague, was reported by Maj. R. A. Kelser, U. S. Army Medical School.

Bone conduction as an aid to hearing for deafened persons attained practical application in America through the development of several portable devices for individual use and one permanent one for group use.

Cyclopropane, gas anesthetic discovered by

Prof. V. E. Henderson, University of Toronto, was used for the first time on a series of patients by Drs. J. A. Stiles and W. B. Neff at the University of Wisconsin.

A device for the removal of plaster casts, working as smoothly as a modern can-opener, was produced in the General Electric research laboratory.

The Persecution of German Scientists

At a meeting of the council of the Association of University Teachers, held at the Imperial College of Science and Technology, Prof. Frank Smith of the University of Leeds said in his presidential address that freedom to teach, to learn and to investigate was the primary requirement of intellectual life. Recently, in Germany, race and political partisanship had been exalted above the ideal of universal learning. Germany could boast a great educational tradition, but now in an orgy of ferocious and narrow nationalism scholars, some of them among the most distinguished in the world, were dismissed because they did not satisfy standards of race, religion or political faith.

Dr. Erwin Schrödinger, professor of theoretical physics at the Friedrich Wilhelm University, Berlin, had to leave Germany, but had found hospitality at Magdalen College, Oxford, where he was elected to a supernumerary fellowship. The idea that an electron is in some way connected with a wave motion of definite frequency, depending on its speed, was brought forward in 1925 by Louis de Broglie. Schrödinger found out the "wave equation" for these waves. He has been awarded the Nobel prize in physics for furthering a new development of the atom theory. The latest estimate gives the number of refugees from Germany to other countries as 60,000, of whom 51,000 are Jews. Nearly all the medical refugees are Jews, but only about half of the scientific refugees. These figures show the political nature of the persecution, which is directed against all persons of pacifist or liberal views. — J. A. M. A., Foreign Letters, 304:104, (Jan. 27) 1934.

Changes In Address

We wish to announce the removal of office of the following members of the Congress: *Dr. Richard Coe* from 75 Lincoln Park, Newark, N. J., to 156 Clinton Ave., Newark, N. J.; *Dr. W. W. Klement* of 4 East Clifton Ave., Cincinnati, Ohio, may now be addressed at P. O. Box 20 Main Office, Cincinnati, Ohio; *Dr. John Wehrly* from 620 N. Main St., Santa Ana, Calif., to Box 1773, Santa Ana, Calif.; *Dr. Farel Jourard* to 251 West 89th Street (at Broadway); *Dr. Winfield Scott Pugh* to 104 East 40th Street, New York.

Matter Created Experimentally From Light and Cosmic Rays

Tangible matter is being created out of light and cosmic rays which come to earth from outer space. Radiation produced here on earth is also manufacturing in some proved instances matter out of intangible waves.

Conversion of mass of the stars to produce light and heat has been the favorite method of explaining their long life. That has been the classic example of the interchange of matter and radiation.

Now evidence is accumulating for the reverse process, the creation of matter out of radiation, not in the far-distant stars, but here on earth.

The idea that matter is created by light or photons was put forth by Dr. P. M. S. Blackett and G. Occhialini of Cambridge's Cavendish Laboratory, in England. The light prefers to perform this miracle only in the neighborhood of an atomic nucleus. The matter is created in the form of a pair of electrons, one positive and one negative.

These Cambridge physicists formulated their theory on the basis of Dr. Carl D. Anderson's discovery of the positive electron and their own subsequent confirming researches.

Experimental evidence for the creation of matter is contained in the bursts of electrons due to cosmic rays observed by Dr. Anderson in his apparatus located at the California Institute of Technology. And Dr. Anderson recently found pairs of electrons formed by the gamma rays given off by thorium. The positrons or positive electrons so formed do not live long, however, since they unite with negatives to form photons or light again.

The latest development is that Dr. J. P. Oppenheimer of the California Institute of Technology and Dr. Milton Plesset, a National Research fellow, have found that the theoretical equation of Dr. P. A. M. Dirac is quite in accord with the facts. This had led to important predictions bearing on cosmic rays.

Photons of high energy much prefer to produce the pair of electrons than to transfer their energy to a single ordinary electron. All of the photons or cosmic rays are equally effective in producing new pairs.

After discussing these new developments with Pasadena scientists, Dr. Niels Bohr, the Danish physicist who is spending some weeks at the California Institute of Technology, commented that the calculations by Drs. Oppenheimer and Plesset have convinced him that the Dirac equation instead of being false is the greatest acquisition to knowledge. — *Science News Letter*, June 10, 1933.

Our Error

Inadvertent grammatical laxities and typographical errors have been noted in a discussion by Dr. McMahon, published in the Archives, January, 1934, and due apologies are offered.

THE STUDENT'S LIBRARY

PHYSIKALISCHE THERAPIE, Klinisches Lehrbuch Für Studierende Und Ärzte. By *Prof. Dr. J. Grober*, Director of the Physical-Therapeutic Institute, University of Jena; and associates: *Prof. Dr. R. Cobet*, Berlin-Berlitz; *Priv. Dozent Dr. K. Gebhardt*, Munich; *Prof. Dr. H. Hofelder*, Frankfurt, A. M.; *Priv. Dozent Dr. A. Reisner*, Frankfurt, A. M.; *Prof. Dr. W. Schultze*, Giessen; *Prof. Dr. J. Strasburger*, Frankfurt, A. M.; *Prof. Dr. A. Strasser*, Wien. Paper. Pp. 364 with 172 illustrations. Price, paper, Rmk. 16, cloth, Rmk. 18. Jena: Gustav Fischer, 1934.

A laudable attempt has been made to include in the space of this single volume the outstanding theories, principles and practices of physical methods, agencies and technics, somewhat similar in plan followed by other authors in other countries. Such a work can only present in somewhat panoramic fashion the many current practices utilized in this discipline, and at best can accomplish nothing more than to present convincing propaganda in favor of physical therapy procedures. This, nevertheless, is a labor worthy of great credit, particularly when presented as to add to the sum total of our knowledge. It indicates the experienced labors of men who must be regarded as authorities in their respective fields. Professor Grober aside from special editorial responsibilities has contributed four of the ten sections, each of which is a well coordinated and comprehensive exposition of the subject. Indeed, every section epitomizes the most advanced information and is presented in such concise fashion as to elicit highest praise. In arrangement of text the work is somewhat of a departure from the routine classification of subject matter. It contains an insufficient discussion of the nature and implication of the states of energy utilized in electro-röntgen and radium therapy, an abbreviation which does not do justice to the size of material devoted to this phase of therapy. It opens the argument whether any text on physical therapy is justified at this stage to more than academically acknowledge the relationship with röntgen and radium practice, let alone devote a third of its space to its exposition. One could with no greater logic incorporate dietotherapy discussions in texts on physical therapy with equal or better reason. Perhaps the best argument for not including such discussions in books devoted to physical therapy is the fact that the material on these subjects is voluminous and can better be expatiated in separate works. The author has, however, managed to incorporate some very important sections, such as discussions on pneumotherapy (breathing gymnastics), therapeutic exercise, radium-emanation therapy, climatotherapy, besides adding to our information on massage, hydrotherapy, light and electrotherapy. The work as a whole is so meaty that it could be read with profit by all.

NATURE, M.D. Healing Forces of Heat, Water, Light, Electricity and Exercise. By *Richard Kovács*, M.D., Clinical Professor of Physical Therapy, Poly-clinic Medical School and Hospital, New York. Cloth. Pp. 172 with illustrations. Price, \$2.00. New York and London: D. Appleton-Century Company, 1934.

This book is undoubtedly the finest popular exposition of the nature and healing qualities of physical agencies written to date in any language. It is a gem for brevity, clarity and unity, and will unquestionably come to be regarded as the most important single volume for legitimate propaganda not only to the lay public but to that vast and uninformed stratum of our profession who are down on physical therapy because they are not up on it. Kovács has again presented a distinct contribution to the discipline in which he has so frequently rendered outstanding service. Written in that charming, informal style which lends itself to descriptive flexibility of expression, it offers detailed information as regards the "nature, mode of action and remedial uses of each of the principal healing forces of nature: heat, water, sunlight, electricity, massage, and exercise"—agencies utilized by Nature, M.D., to regulate, correct and cure many of the innumerable ailments refractive to classical therapeutic methods. As a supplement to the sincere hope of the author "that lay people interested in these newer methods of treatment" will afford themselves the opportunity of the information contained in this book, the general advice is offered that every physician interested in any part of the agencies here expatiated provide for his office reception room and for special patients opportunities of reading this book, a provision which will advance the popularity of these treatments which in time will create legitimate sources of income and aid in removing the unpleasant suspicions retained in the minds of majority in the profession regarding the scientific value of this discipline. The author deserves highest praise for a timely contribution of great value.

SKIN DISEASES AND NUTRITION. Including the Dermatoses of Children. By *Erich Urbach*, M.D., Dozent in Dermatology at the University of Vienna. Authorized English translation by *Frederick Rehm Schmidt*, Clinical Instructor of Dermatology, Northwestern University, Chicago. Cloth. Pp. 242 with 55 illustrations, 8 diagrams and 10 tables. Price, Rmk. 25.20. Vienna: Wilhelm Maudrich, 1932. (American Agency: Chicago Medical Book Co., Chicago.)

This American edition of the original German work merits the most serious study not only by dermatologists but by general practitioners as well. There can be no question that improper nourish-

ment and gastro-intestinal dysfunctions play important rôles in the causation of a large number of protracted and annoying skin diseases which may be gratefully aided by a rational dietetic regimen.

One can say without risk of a charge of exaggeration that between the covers of this highly practical yet scientific book one will find the most authentic information about problems which in the past have taxed the patience of both physician and patient.

The book is divided into a General and a Special Part. In the former the author discusses the influence of nutrition on the skin, the skin affections due to alimentary intoxications and infections, and the dermatoses caused by digestive dysfunction and by metabolic disturbances. Chapters dealing with nutritional allergies as causative factors of dermatoses and of affections of the mucous membranes present an exhaustive review of recent research work in this rich field of endeavor. In the Special Part the author takes up a large number of individual skin diseases, many of which are so well illustrated as to present a veritable dermatologic clinic. Naturally their dietetic treatment is being stressed, the author having overlooked none of the worth while dietetic systems which have been evolved, especially those of Gersuny, Hermansdorfer and others.

In a Supplement the weights and lengths of children have been tabulated and the value of food charts expounded. An index of subjects and a register of about 600 authors quoted in the text conclude the volume. The book has been printed in Vienna and represents the best in workmanship of the bookmaker's art. The English translation has been done most admirably by the distinguished Chicago dermatologist.

THE 1933 YEAR BOOK OF SURGERY. Edited by *Evarts A. Graham*, A.B., M.D., Professor of Surgery, Washington University School of Medicine; Surgeon-in-Chief of the Barnes Hospital, St. Louis. Cloth. Pp. 826 with 229 illustrations. Price, \$3.00. Chicago: The Year Book Publishers, Inc., 1933.

Under the above new and better title the publishers present the 1933 volume of the well known annual of medical reviews. This year's report of surgical progress is again under the scholarly editorship of Dr. Graham. The arrangement of the subject matter has been maintained as in the preceding years. A brief Introduction by the editor points out the year's most striking contributions to surgery. This is followed by no less than 800 pages of abstracts of the world's surgical literature. As the book covers the entire range of General Surgery it precludes detailed discussion. Suffice it to say that

the abstracts have been carefully selected and that the editor often adds critical comments of real interest. An index of 21 pages aids the reader in quickly finding information on any desired subject, the names of authors, too, being given in alphabetic order. Print, paper, and binding are of excellent quality.

THE DIGESTIVE TRACT. A RADIOLOGICAL STUDY OF ITS ANATOMY, PHYSIOLOGY AND PATHOLOGY. By *Alfred E. Barclay*, O.B.E., M.A., M.D., D.M.R.E., Lecturer in Medical Radiology, University of Cambridge. Sometime President, British Institute of Radiology; Electrotherapeutic Section, Royal Society of Medicine, etc., etc. Cloth. Pp. 395 with 275 illustrations. Price, \$12.00. Cambridge: The Cambridge University Press, 1933.

The inspiration for a work whose comprehensiveness and importance this book is a fair example, often arises from personal experiences and from sources so varied in character as to defy classification. The author's acknowledgment of his debt to the many unregistered workers responsible for some of the splendid thoughts incorporated in this text is the generous gesture of one cognizant of the formative influence of these unknowns upon his present opinions. This work is the outgrowth of a quarter of a century of fluoroscopic and radiographic examination of the alimentary tract, elaborated to its present dimension from an M.D. thesis published in 1912 and 1915. As already indicated the discussions incorporated are comprehensive and important, not because of size, but rather because of the advanced and scholarly information introduced. Indeed the entire subject has been written with such critical care for the facts presented that it must be regarded as a contribution of the first importance to both gastroenterologists and radiologists. It points out the correct and warns against fallacious methods of radiologic observations, calling attention that the "diagnosis of the abnormal can only be based on the recognition of the normal and an appreciation of the limits of normality." The text has been classified into three major divisions, these being subdivided into special sections, 19 chapters, and five special appendices, discussing the radiological problems of the digestive tract from its anatomical, physiological and pathological aspects. The various sections and chapters have so logically brought out the important data on the subject as to make this one of the most representative and scholarly expositions on the subject. One closes the book with the impression that the author has contributed an outstanding discussion to this branch of practice. It contains a comprehensive bibliography and a complete index.

INTERNATIONAL ABSTRACTS

Transurethral Prostatic Resection. A General Estimate and a Special Study of Twenty Physician-Patients. Gershon J. Thompson, M.D.

Cal. and West. Med., 40:1, (Jan.) 1934.

The author gives his recent experiences with and criticisms of the operation. He cites the anatomical indications, describes the procedure which was used and the postoperative care, and then comments:

The method is not in the experimental stage. It is now the surgeon's responsibility to acquire cystoscopic skill and that familiarity with the neck of the bladder which results from perfect visualization and exact knowledge of the surgical pathology of the prostate gland. He can, then, after learning the rudiments of the technic of transurethral resection, operate with a lower mortality rate than can the prostatectomist. The surgeon who is not sufficiently experienced to do good cystoscopic work must either acquire the experience, or else perform prostatectomy despite its higher mortality rate. Death from transurethral resection in my experience, and that of my colleagues, has been rare. In the last six years there have been only seven deaths, a mortality rate of 1.4 per cent, and one consecutive series of 291 patients, including these twenty doctors, was operated on without a fatality.

With no exception, the twenty physicians were relieved of their obstructive urinary symptoms. One physician, who could void an excellent stream at the time of dismissal, had residual urine of less than two ounces (60 cubic centimeters). The unstinted expressions of appreciation received in recent letters must have been inspired, in some instances, by the recollections of the days of prostatectomy. All of those who wrote insisted that, if necessary, they would again submit to transurethral resection rather than to any type of prostatectomy.

The question of recurrence seems to be settled by results in a series of 499 cases in which operation was performed between January 1, 1927, and January 1, 1933; there were eleven recurrences, or an incidence of 2.2 per cent. One might argue that it is too soon to quote exact figures concerning recurrence in cases in which the glands were large. I agree, but it is my firm belief that in the future the percentage of recurrence during, say, a period of five years, will be considerably less than the percentage of immediate death noted in the past from prostatectomy. Also, I believe that the percentage of deaths during the five-year period among aged patients, from causes not related to the urinary tract, will be higher than the percentage in which urinary obstruction will recur. Furthermore, I have no doubt that the incidence of persistent or recur-

rent urinary distress of any kind will be far less following transurethral resection than has been noted for years following prostatic enucleation. If these predictions prove true, prostatectomy, like prosperity, has had its day. There is a bare possibility of both coming back, but never in their former glory.

The Treatment for General Paresis by Means of the Electric Cabinet, Arsenicals and Typhoid Vaccine. Emil T. Hoverson, M.D., and George W. Morrow.

Ill. Med. Jour., 44:547, (Dec.) 1933.

The conclusions of these authors are:

1. Twenty-five male patients have been treated by means of the electric cabinet, arsenicals and typhoid vaccine.

2. Of the twenty-five patients so treated 13 have shown sufficient improvement to warrant their release. This expressed in percentage is 52.0 per cent of the patients treated.

3. Apparently it is the hyperpyrexia, and not the way it is produced, that is the beneficial agent in paresis.

4. There are certain cases of paresis which show no improvement in spite of intensive anti-paretic treatments.

The Surgeon's Duty in Cancer of the Cervix Uteri. Harry S. Crossen, M.D.

Ill. Med. Jour., 64:123, (Aug.) 1933.

This writer concludes his paper with the following summary:

1. To give that patient the benefit of intensive effective irradiation for devitalization of the cancer cells throughout the pelvis, recognizing that the cure hinges on devitalization of the outlying cancer cells along the pelvic wall.

2. To give that patient the benefit of any operative procedure that may enhance the effectiveness of the irradiation - devitalization process.

In exceptional conditions some local operation may allow better implantation of the radium. However, this use of the knife or cautery is seldom needed and should be employed only where clearly indicated for a specific purpose, otherwise it is likely to do more harm than good. When required, operation should supplement irradiation and not displace it.

3. To protect that patient from half-way measures — from so-called radical operations that never reach the outlying cancer cells, and from ineffective radium and x-ray treatments that carry no devitalization into this distinct crucial zone.

4. Another important item in my duty as a

surgeon in lessening deaths from cancer of the cervix, is in preventing such cancer.

There are three parts in this work of prevention; first, prompt removal of chronic irritation in the cervix when encountered in practice; second, advice to patients as to the advisability of examination for the detection of such lesions and, third, active participation in the campaign of public instruction in cancer prevention, particularly that part of it which has to do with the detection and elimination of chronic irritation in the cervix.

The Treatment of Lichen Ruber Planus with Quartz Light. E. Swirsky.

Presse Medicale, 3, 1933.

"The quartz light treatment of lichen ruber planus may be regarded as the method of choice, since failures practically do not occur and recurrences are rare. However, a strong erythema followed by abundant desquamation must be achieved, which is not so easy to attain in these cases. In cases of generalized lichen ruber planus the entire surface of the body (covering the face and eyes) is divided into four sections, each being irradiated in intervals of two days at a distance of 60 cm. from the lamp. At the beginning fifteen to twenty minutes, increasing to forty-five minutes with strict observation of the action achieved. In general, 12, rarely 15 to 20 sittings are necessary. In cases with circumscribed areas, either the entire skin is covered off or the area is treated with concentrated rays, possibly with compression, at the beginning every second day at a distance of 10 to 20 cm., for ten minutes, later at a distance of 60 cm. for a longer time. In a similar manner lichen planus of the buccal cavity is irradiated with a special compression lamp, carefully beginning with two minutes, increasing two or three minutes each time until fifteen minutes, alternating between compression and 1 cm. distance. Recurrences are rare and disappear on two or three further irradiations. The action of the ultraviolet rays depends on exfoliation, intense vascular dilatation, rapid and intense cell renewal."—Ars Medici, (Aug.) 1933.

Fluorescence of Carcinogenic Substances. B. Grynkrant.

Néoplasmes, 12:5, 1933.

In this discussion of his "actinic hypothesis" of cancer the author suggests that malignant disease may be the result of an interaction between radiant energy (mitogenetic rays, cholesterol, sunlight, or radioactive substances like potassium) and fluorescent sensitizers such as tar, creosote, anthracene, hematoporphyrin, etc.

At any rate, the organism of the cancer patient resembles one that is under the influence of feeble but continuous irradiation, and the hypothesis of a lightantigen (Jansion, Sohler, and Hyronimus: Fifth International Cong. Physiotherapy, Liège, 1930), ineffective for a normal organism but very

active when sensitization has been accomplished, is an alluring one. — A. J. Cancer, 19, (Oct.) 1933.

Physical Measures in Hypertrophic Rhinitis. A. R. Hollender.

Ill. M. J., 63:269, (Sept.) 1933.

Clinical experience shows that with the correction of dietetic errors and dysfunctions of metabolism, conservative local measures suffice to reduce the size of the hypertrophied inferior turbinate. Cauterization by chemicals and by intense heat has been tried and found wanting. It is clear that cauterization should have only a limited place in rhinologic surgery, as indeed we now possess in our armamentarium means by which we can attain satisfactory therapeutic results without at the same time causing harm.

So far as hypertrophic rhinitis is concerned, none of our classifications can serve us for therapeutic guidance. For this purpose a new grouping is suggested: 1, *simple, chronic rhinitis*; 2, *congestive rhinitis*; 3, *hypertrophic rhinitis of a mild grade*; 4, *hypertrophic rhinitis with turbinal osseous overgrowth*.

The development of physical therapy as an integral part of general medicine and surgery has added to rhinologic therapy, three procedures, namely, zinc ionization, medical diathermy and electrosurgery, each of which is effective in certain types of rhinitis. The technic is detailed. It is emphasized, however, that these measures represent no cure-all for every type of nasal or sinus disease. There are definite limitations for their use.

In conclusion, the author states:

1. Physical measures in simple chronic and hypertrophic rhinitis have afforded more prompt and better results than the older forms of cauterization.

2. Hypertrophy of the nasal mucous membrane, and in particular that of the inferior turbinate, being the main pathologic consideration in hypertrophic rhinitis, treatment is directed toward the reduction in size of the turbinate to overcome symptoms of nasal stenosis.

3. Zinc ionization, medical diathermy, and intramural electrocoagulation are free from undesirable effects, and give favorable results in cases amenable to conservative therapy.

4. Because of the conservative nature and therapeutic efficacy of physical measures in hypertrophic rhinitis, they merit wider application in rhinologic practice.

Diathermy and Deafness. D. McKenzie.

Brit. J. Phys. Med., 8:39, (July) 1933.

McKenzie reports the use of diathermy in the treatment of certain forms of deafness. The electrodes that he uses are two equal flat metal plates. He has found it best to treat each ear separately, placing one electrode over the mastoid and the other on the opposite cheek just below the molar eminence; in this way the "beam" of diathermy traverses the middle ear and the entire length of the Eustachian tube. Each ear is treated for about

twenty minutes. The patient must be cautioned to complain at once if the sensation of heat "rises above what he feels to be quite comfortable." Diathermy should not be used if there are any signs of acute otitis media, or if there is any tendency to epistaxis when the seat of the bleeding cannot be discovered and treated. The best results are obtained in those cases where the cause of the deafness is a recent otitis, whether catarrhal or purulent. It is particularly valuable in cases of purulent otitis where the discharge has ceased, but deafness persists. In catarrhal otitis, adenoids are usually present in children, and nasal sinus suppuration in adults. These conditions or any disease of the nasopharynx must receive appropriate treatment before diathermy is applied to the ear. In chronic deafness of long standing the author has found diathermy of value at certain times, especially if there is a sudden aggravation of deafness due to prolonged exposure to cold or depressed general health. The author has not found diathermy of value in nerve deafness, nor for the relief of tinnitus. He has found that if six treatments with diathermy do not cause any improvement, it is useless to continue it; but if definite improvement is noted, the treatment should be continued at regular intervals with interruptions of a week or two, as long as the hearing continues to improve.

X-Rays as an Aid in the Treatment of Some Chronic Conditions. J. W. Torbett.

Texas S. J. Med., 29:444, (Nov.) 1933.

Torbett reports that mild x-ray treatments over acutely inflamed areas or organs, or over the sympathetic ganglia supplying areas in which disease conditions of the neurovascular type exist, have been of great aid in relieving pain, inflammation and promoting health and normal function. Small doses repeated in amounts and frequency according to the reactions secured are valuable aids in treating many acute and chronic diseases and assist other physical agents in restoring health.

Management of Gonorrheal Arthritis. D. W. Hedrick.

A. J. Surg., 22:255, (Nov.) 1933.

Ammonium iodoxy benzoate is of definite value in the treatment of gonorrheal arthritis. It is best used as an adjunct to the usual orthopedic measures: (1) short period of rest, preferably in plaster, for four to ten days; (2) physical therapy: diathermy, massage and active motion as soon as the pain disappears. In the milder cases its use permits a patient to be ambulatory who might otherwise be confined to the hospital. Insufflation of the knee in the synovial type of gonorrheal arthritis is described. We feel it hastens resolution of the process, promptly relieves pain and thus permits early motion, preventing the formation of intra-articular adhesions and muscular atrophy from prolonged immobilization. Aspiration, irrigation or even drainage is sometimes necessary for the purulent type of infection, but amiodoxyl again seems to hasten the resolution and certainly relieves the

discomfort. Splinting in a position of rest is necessary for a time, but early motion should be started as soon as the acute stage is over and pain is relieved. With this, diathermy and massage have been found to be the most valuable type of physical therapy. Hyperpyrexia by fever diathermy is useful, especially in refractory cases. Twenty-two cases are reported, 11 of which were treated with the adjuncts already described. Of these 40 per cent were completely cured, 40 per cent much improved and 20 per cent developed ankylosed but painless joints. The remaining 11 are presented for comparison and received neither amiodoxyl, insufflation nor hyperpyrexia therapy. Of these 30 per cent showed no improvement; 10 per cent recurred; 20 per cent resulted in ankylosis; 40 per cent showed slight improvement. Six cases in which the advocated treatment was used are reported in detail.

Therapeutic Fever Produced by Diathermy. J. C. King.

Radiol., 20:449, (June) 1933.

King describes the method used by him for producing therapeutic fever by diathermy and reports results obtained with this method by himself and others. The machine used is of the variable-frequency type capable of producing 10,000 ma. By use of a special voltage divider, constructed by H. D. Roop, two patients can be treated at the same time. The electrodes used almost completely cover the anterior and posterior surfaces of the trunk, are adjusted so as to fit snugly to the skin surface and so that the distance between the anterior and the posterior electrode is equal at all points; they are held in place by a jacket with elastic straps. No conductive material is used on the surface of the electrodes. Treatment is carried out with the patient in bed, wrapped in rubber sheets and blankets to prevent heat loss. As the patient feels considerable discomfort when the temperature is brought to 102 degrees or 103 degrees F., sodium amytal is given per rectum immediately preceding treatment. The current is increased gradually from 5,000 to 7,000 ma. in fifteen minutes; it is kept at that milliamperage until the temperature is within 1 degree F. of the level desired and then shut off. Temperature, pulse and respiration are recorded every fifteen minutes from the time the current is turned on until the temperature returns to normal. The author's first use of this method was in paresis; the results have been better than with malarial injections, with an increased percentage of good remissions; similar results have been reported by others. Equally good results have been obtained with other forms of neurosyphilis but in a smaller series of cases. For the best results the author recommends intravenous antisyphilitic medication just before the diathermy treatment. The author has also used this treatment in cases of chronic arthritis of both the hypertrophic and the atrophic type. The results have been "most striking," as every patient has noted some relief of pain, increased motion of the joints, improved color of the skin, and a sense of general well-being. In a number of cases complete relief has been obtained; the author advocates the continued use of treatments

at gradually increasing intervals for a long period after the maximum degree of relief is obtained. Diathermy also offers the best means of treatment of thromboangiitis obliterans, as it dilates the capillary bed to the fullest extent without an initial vasoconstriction.

Transurethral Prostatic Resection — Technique and Results In 205 Cases. Gershom J. Thompson.

A. J. Surg., 21:421, (Sept.) 1933.

The use of the multiple needle electrode controls bleeding from all but the larger vessels. The period of coagulation and amount of current will depend on the generator used and the type of gland. The object of this electrode is to desiccate only the path through which the tubular knife will pass. One should not coagulate too much, for the burned tissue must either slough away or be absorbed, and the post-operative reaction varies to a great extent, in my experience, according to the amount of such tissue present. At any stage in the procedure, when bleeding from the larger vessels becomes troublesome, one can control it with the Bugbee electrode, as described previously by Bumpus.

In only one case in this series of 205 has it been necessary to control early post-operative bleeding by further electrocoagulation, and in no case has any of the hemostatic bags been employed.

Severe post-operative hemorrhage after the tenth day has occurred in 5 per cent of cases, and it has been necessary in 6 cases of these 205 to remove clots from the bladder through the cystoscope. In no case has suprapubic cystostomy been necessary to evacuate the clots or control bleeding. Perforation of the bladder, or any other mishap requiring suprapubic operation, has not occurred in the last year following transurethral prostatic resection.

The period required for complete healing is variable. Cases in which the resection is extensive require a little less than three weeks, most of which time the patients are ambulatory and do not require care in hospital. By the twenty-first day after operation all the sloughs have come away and the danger of delayed bleeding, in my experience, has passed. In many cases the urine is crystal clear and cultures are negative. There were no deaths in this series. It is, of course, too early for true recurrence to have developed in these cases. This series of 205 cases, encountered in the first nine months of 1932, includes one patient operated on the second time early in January, the first operation having been done in the last week of 1931. Only five can be classed as cases of recurrence. Three of these patients had benign hypertrophy for which punch operations had been performed three, six and seven years previously. The two others had carcinoma, and resection was performed a second time, respectively eight months and thirteen months after the initial operation.

Sarcoma of the Larynx. Frederick A. Figi.

Arch. Otolaryng., 18:21, (July) 1933.

Sarcoma of the larynx, once regarded as of not uncommon occurrence, has come to be regarded as rare. This is because pathologists have changed their interpretation of histologic observations and not because there has been a decrease in the incidence of the disease. Many neoplasms of the larynx formerly thought to have originated from supporting tissue elements have come to be considered by laryngologists and pathologists as of epithelial origin. The small number of proved laryngeal sarcomas, or the complete lack of them, observed by those reporting the largest series of cases of malignant tumors of the larynx would seem to be the best criterion as to the rarity of the condition.

The treatment of sarcoma of the larynx depends on its size, situation and activity. Since many of these tumors are pedunculated, show less tendency to infiltrate the laryngeal structures and metastasize later than do carcinomas of the larynx, they may remain operable for a considerably long period. Many of them are quite inactive and in an early stage may be removed readily by means of direct, indirect or suspension laryngoscopy. If such removal is followed by electrocoagulation of the attachment of the tumor, the prognosis will be good in many cases. If the tumor is too extensive to remove in this manner, laryngo-fissure or laryngectomy may be necessary. The first lasting success on record following laryngectomy was achieved by Bottini of Turin, in 1876, in a case of mixed round and spindle cell sarcoma of the larynx. The patient was known to be in good health more than three years later.

Thyrotomy is especially useful in the treatment of sarcoma of the larynx, since many of the growths are pedunculated, and there is little tendency for them to cross either commissure to involve both sides of the larynx. Even though the tumor may be extremely large and completely fill the larynx and upper part of the trachea, it may on exploration be found to spring from a comparatively small pedicle with a well localized attachment, so that removal through laryngofissure can be carried out readily. In general, it would seem that the most conservative type of procedure permitting removal of the growth should first be carried out in cases of the more inactive types of neoplasm, as the records of cases of this type show that even when recurrence took place there was not sufficient activation to prevent removal by a somewhat more radical operation later, and the prognosis was apparently little affected. In dealing with carcinoma of the larynx, on the other hand, ultraconservatism is entirely inadvisable, since in many cases it has definitely jeopardized the patient's chances of getting well.

VOLUME CHANGES IN ORGANS INDUCED BY THE LOCAL APPLICATION OF EXTERNAL HEAT AND COLD AND BY DIATHERMY *

SIMON BENSON, Ph.D.

CHICAGO

The work reported here was prompted by the results obtained in a previous investigation⁽²⁾ of certain thermic effects on joints stiffened by acute traumatic injuries. It was thought that there may be a relationship between the induced vascular and volume changes and the subsequent variations in motility, as shown by the previous work.

Methods

Volume changes following heat applications were determined by water displacement of the limb. The water into which a foot was submerged before application of heat, was usually at about 34° C., the average skin temperature; but for the measurement following heat application, the water temperature was raised to about 44° C., or close to the existing skin temperature, in order to prevent as much as possible, rapid reflex volume change during the measurement.

The measurements were taken by having the subject standing upright with one foot in a cylinder. The subject was instructed and trained to stand "exactly the same" during all measurements — i.e., the foot was placed as nearly as possible in the same place and position in a cylinder; that the back of the heel and the calf muscles just touched the cylinder wall, and with equal weight on both feet. With these precautions, the sensitivity of the apparatus (Fig. 1) yielded measurements of the foot and leg volume with a maximum error of 3 to 5 per cent. Average errors in all probability, do not exceed 5 cc. per test; and since errors are as likely to be (+) as (—), a large number of measurements will largely eliminate their influence, and may be ignored in the final averaged results.

We know of no method by which the treated limb may be replaced in the measuring vessel for a second measurement with greater accuracy. The arm or the leg cannot be re-

placed into the ordinary plethysmograph with any greater, if as great, accuracy as can a foot into a cylinder when the same body weight is brought to bear upon it during the measurements. The method is rapid as well. With but slight changes in the arrangement of indicators, etc., the device is applicable in all of our investigations, thus eliminating the introduction of new devices and new errors.

The subjects were almost all active athletes — apparently in the best of health. The results obtained can, therefore, be considered as reactions in normal men. It is true that as for the results of the first part of this report some of the measurements were obtained upon individuals with sprained ankles and other local acute injuries, such as bruises and contusions, but the majority were well on the road to recovery, there being little or no swelling left to introduce any noteworthy error in the results.

Hot water was applied to the subject standing with the foot submerged in whirling water; but in the diathermy tests, the subject was sitting with the foot placed upon a large electrode lying on the floor, and the other electrode placed as a cuff around the leg just below the knee. This we felt was the best arrangement of the electrodes to insure the most thorough application to all parts of the measured foot and leg. Hot air was applied with the subject sitting with the foot extended horizontally into the baker, with the part exposed to the heat always wrapped in toweling. The position of the subjects (standing, sitting) is emphasized here because of the possibility that a variation in the hydrostatic pressure of the blood in the foot and ankle might influence the change in volume — especially at temperatures at which the skin blood vessels undergo marked change in tone.

The volume-measuring device was so constructed that it, with but slight changes or eliminations of indicator arms, etc., served satisfactorily in all three types of investigations. In Figure 1, it is shown as set up for

* This study has been aided by a grant from Mr. C. F. Samms, President of the General Electric X-ray Corporation, Chicago, Ill.

From the Physiological Laboratory and the Department of Physical Education, University of Chicago.

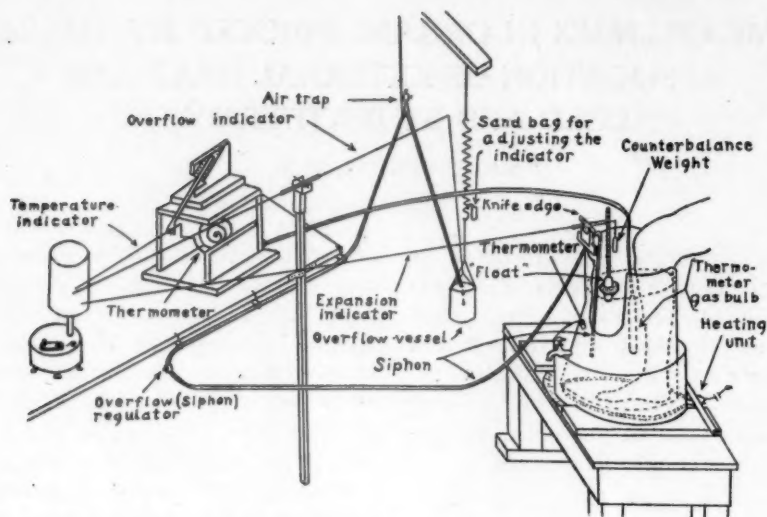


Fig. 1. Shows set up of apparatus for determining volume changes in organs detailed in this report.

experiments with water of a rising temperature — from 3° C. to 47° C. Since this arrangement is the most complex, an explanation of it will be given here; and the set-up for the other experiments may then be made clear by merely mentioning what parts were eliminated.

The cylinder itself was placed inside another vessel, and being soldered on top of small metal blocks resting on the bottom of the larger vessel, a space or air jacket was formed between the walls and bottoms of the two vessels. Between these bottoms was placed an electric heating unit which served to heat the water with which the entire intermediary space was filled during an experiment. The heat from this water was readily transferred through the copper walls of the cylinder itself to the water inside surrounding the foot. In this manner, the water in the cylinder was easily and uniformly raised to, or maintained at, any desired temperature.

To maintain low constant temperatures for the experiments recorded in the third part of this report, we employed another cylinder similar to this, but with the outside vessel almost as high as the inside cylinder. The intervening air space was then filled with ice water, or freezing mixture, if such proved necessary, to maintain a low constant temperature of the water inside the cylinder itself. Two cylinders were also necessary to permit a rapid change from one temperature to another. The water contents of the two

cylinders were brought to the desired temperatures and the foot merely brought out of one and quickly plunged into the other.

The expansion indicator resting on a knife-edge, proved adequately sensitive. Its arms were of proportion of one to thirty-six (1:36), and the writing point on the drum recorded very slight volume change inside the cylinder. The efficiency of this indicator was due largely to the specially constructed float. After considerable unsatisfactory experimentation with several kinds of floats, the one shown in the figure was finally devised and adopted. A rim was placed on the float, and the whole lever so counterbalanced that this rim was "gripped" by the surface film of the water. It proved very accurate. If for any reason the rim was lifted away from the surface film, the equilibrium of the indicator was so greatly disturbed that the whole float was lifted far out of the water.

The thermometer registering temperatures in the cylinder was of a "gas unit" type. The bulb submerged in the water, and the spiral spring connecting with the temperature indicator, as well as the tube between the spiral spring and the bulb, constituted one continuous closed gas chamber. Heating the gas bulb, thus producing higher pressure in the gas chamber, served to straighten the spring, which then moved the temperature indicator on the kymograph. The temperature was checked by a mercury thermometer inserted through an aperture in the cylinder wall.

The over-flow indicator was connected with

TABLE 1—Summary of Measurements of Volume Changes in Foot and Leg Induced by Heat Application of Hot Water, Hot Air, and Diathermy.

Type of Heat	No. of Persons	No. of Tests	Duration of Tests	VOLUME CHANGE IN CC.		
				High	Low	Average
Hot Water. (40°-47°)	19	35	5'-20 min.	100 (5.3%)	24 (1.14%)	51.5 (2.76%)
Hot Air. (Up to 160° C.)	11	18	30'-80'	85 (5.8%)	-45 (-2.37%)	42.2 (2.38%)
Diathermy. (350-600 m.a.)	12	22	15'-40'	108 (5.26%)	2.0 (.09%)	54.5 (2.88%)

the over-flow vessel which, in turn, was suspended from a spiral spring. In order to secure a sensitive starting position of this indicator, it was first set at some point below the one desired on the kymograph. Sand was then poured into a small container suspended on the spiral spring until the writing point on the kymograph rose to the desired point. The indicator was now so delicately adjusted that the passing of but a few drops of water from the siphon into the over-flow vessel was immediately observed on the drum.

Before submersion of the foot, the cylinder was filled with water to a height which brought the indicator to some convenient mark. In order that this height should not vary from time to time, the indicator point was read against an upright permanent scale in place of the kymograph. To ascertain the volume of the foot, then, all that seemed necessary was to submerge the limb in the cylinder and then withdraw sufficient fluid to bring the indicator point back to the original mark. This, however, was soon discovered to introduce an error of from 20 to 40 cc. in each measurement. This was due to the adhering of water to the sides of the cylinder as well as to the leg, as the water level was lowered to its original height by the withdrawal. The variation in error was due to two causes: First, the height to which the liquid rose — which in turn depended on the volume of the foot submerged and, second, to the rate of withdrawal of the water. Over the latter we had fair control, but none, of course, over the former. Both of these sources of error were eliminated by withdrawing an amount of fluid slightly greater than the foot before the latter was submerged. Then, as soon as the foot had been placed in the cylinder, a sufficient amount of the withdrawn fluid was returned to place the indicator in its original

position. The remainder of the withdrawn fluid accurately represented the volume of the foot. As the foot was removed from the cylinder, it carried along considerable water, but this error was eliminated from the second measurement by refilling the cylinder to the original height, and then repeating the withdrawal procedure as described above.

Results

Measurements of the influence of the local application of the three types of heat are summarized in Table I. It will be seen that the increase in organ volume (vaso-dilatation, edema?) is nearly the same from each type of heat. If at the end of one test the local vaso-dilatation was maximal, the percentage volume increase is necessarily influenced by the initial state of the blood vessels, and this, in turn, is determined by many factors beyond our control. Where repeated tests were made on the same individual, it was found that, as a rule, the initial volume of the foot and leg was smaller in the morning than in the afternoon.

But the increases in limb volume after heat, as applied in these tests, do not seem to involve maximum vaso-dilatation. Seven tests were made using diathermy after the standard hot water or hot air application, and a further increase in leg volume was obtained (average 20 cc. or 1.03 per cent). Similar results (average 21 cc. or 1.12 per cent increase) were obtained in 20 tests on 10 persons when the hot water application followed one of diathermy or hot air. Some local edema may be involved in these cases. One might conclude, of course, that maximum dilatation would be produced by each form of heat if it were applied longer; or else that each form of heat produces, in part, some special vasomotor irritation and dilatation which cannot be obtained by any other

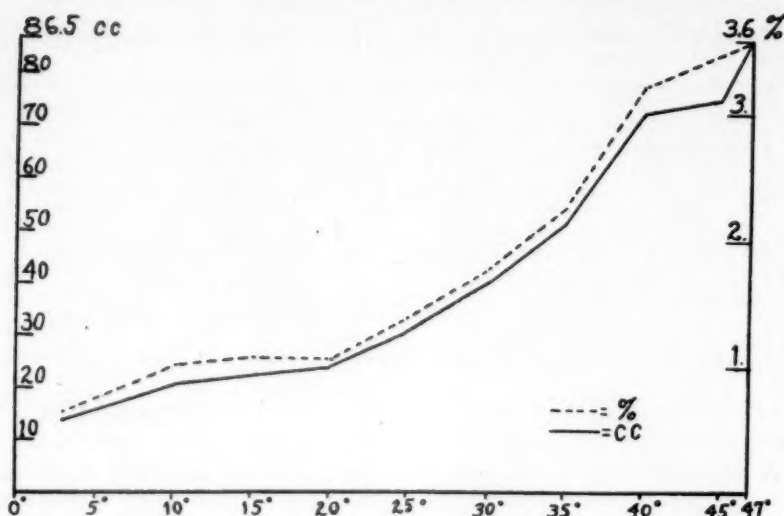


Fig. 2. Volume changes of foot and leg, based on the average of seventy-nine tests on seventy-two subjects.

form of heat, no matter how long it is applied.

The following experiments, with a rising temperature, were undertaken to ascertain whether or not sudden changes in limb volume appear at some particular temperatures. In these experiments it was imperative that the foot be held quiet for a considerable time. The slightest movement of the leg, or even the toes, was recorded on the graph. If the indicator returned to its previous position, such artifacts could be ignored. It is hardly necessary to mention that in these experiments the subjects were not standing, but sitting in a comfortable chair with arm rests.

After the cylinder had been filled to the desired point with water at about 4° C., the foot was quickly submerged and its volume determined by the withdrawing procedure previously described. This operation of correctly inserting the foot and getting the expansion indicator pointing at the desired height on the kymograph drum, need not, after a little practice, require more than five or six seconds. Before the foot was inserted into the cylinder, the expansion indicator, properly attached, was brought in contact with the kymograph drum and the latter revolved so as to enscribe a base-line about one centimeter from the lower edge of the drum. It was to this line the indicator point was returned after the foot was inserted. The temperature, and overflow indicators were adjusted to the same line. (Fig. 1.)

As soon as the foot had been inserted and

the expansion indicator adjusted to the base-line, the current was turned on in the heating unit located below the cylinder. This, as previously indicated, warmed the water in the outer vessel; and the heat was quickly transferred through the cylinder wall to the water surrounding the foot. The rise in temperature inside the cylinder was immediately recorded on the drum by an upward movement of the temperature indicator. The slightest expansion inside the cylinder, due either to volume changes of the leg, or of the water itself, was at once indicated by the expansion indicator by a downward movement on the drum. As soon as the latter movement started, the siphon was opened by means of the over-flow regulator. This released a flow from the cylinder through the siphon to the overflow vessel. By careful manipulation of this regulating device, water was removed from the cylinder as fast as expansion occurred, and quantitatively transferred to the overflow vessel. The latter, being suspended in a spiral spring, descended proportionally to the amount of water transferred to it, and being also attached to the overflow indicator, it produced an upward movement of the latter on the drum.

The graph thus obtained from the overflow indicator registered the combined expansion of the leg and the water. The expansion curve of the water could easily be plotted from tables and then subtracted from the combined overflow curve. In order to eliminate any errors which might possibly originate by a

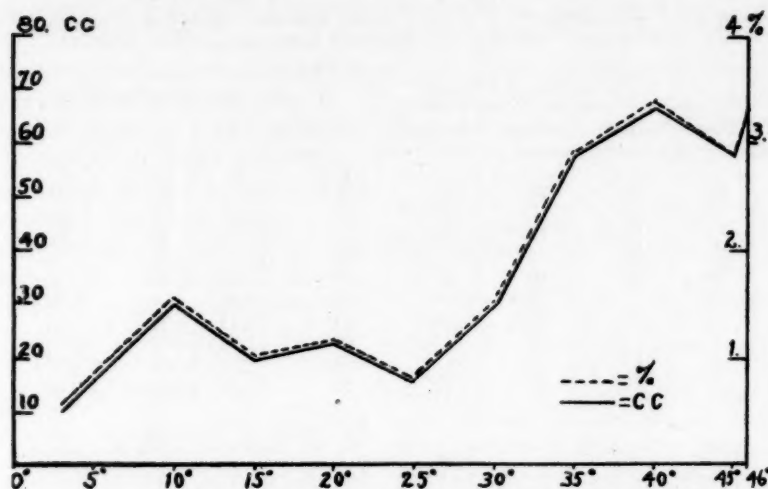


Fig. 3. Volume changes of foot and leg of subject H. P. All applications, in this case, of 10 minutes duration.

slight expansion of the cylinder itself from the heating, we preferred to obtain our own water expansion curve under conditions similar to those under which the experiment itself was performed. To do this, each experiment was always repeated with water only, the water volume used being equal, of course, to that surrounding the limb in the original experiment. The curve obtained from the water alone was then subtracted from the previously obtained combined curve of the foot plus water; and the resultant gave us the true expansion curve of the limb. Eleven of these curves were obtained. The numerical data are presented in Table 2.

Subject 1.—Age 29; weight 120 lbs.; of a quiet and moderately active type, but not athletically active. Later records show a leaning to brooding and moodiness, which developed into definite psychopathic symptoms.

Subject 2.—Age 28; weight 160 lbs.; no regular athletic activity.

Subject 3.—Age 40; weight 170 lbs.; engaged in athletic activity with considerable regularity.

Subject 4.—Age 19; weight 150 lbs.; engaged in athletic activity with considerable regularity.

The expansion averages of 2.8, 3.6, 5.2 and 5.3 per cent provoke speculative conclusions as to the existence of an individual "expansion coefficient." The value of such a coefficient, should its existence be established by more extensive studies, may prove of considerable theoretical and practical interest.

The only unexpected result obtained from the application of water with a rising temperature was the failure to obtain a diminu-

TABLE 2.—Limb Volume Expansion on Gradual Increase of External Temperature From 4° C. to 47° C.

Subject	Temperature	Time	Starting Vol- ume	Increase in cc.	%	Individual Average in cc.	%	
1.....	4° C.	46° C.*	21'	1665	42	2.52	47.5	2.8
1.....	4° C.	46° C.	30'	1724	53	3.07		
2.....	4° C.	47° C.	28'	2040	63	3.08		
2.....	4° C.	47° C.	23'	2145	62	2.91	72.3	3.6
2.....	4° C.	47° C.	23'	1915	92	4.8		
3.....	4° C.	47° C.	22'	2130	91	4.27		
3.....	4° C.	47° C.	25'	2115	124	5.86		
3.....	5° C.	47° C.	25'	2160	109	5.04	111.8	5.2
3.....	5° C.	47° C.	30'	2160	123	5.69		
4.....	5° C.	47° C.	25'	1950	100	5.12	103.5	5.3
4.....	7° C.	47° C.	25'	1975	107	5.41		

* Subject No. 1 was unable to tolerate a higher temperature than 46° C.

tion of limb volume after the submersion of the foot in cold water. At no time did the volume indicator show a volume decrease. At the low temperature, this increase was slow, to be sure, but constant. As the temperature rose, the rate of increase would vary considerably, not only with the different subjects but also to a marked extent on repeated tests on the same individual. In general, however, these came a rapid increase as the temperature rose above the normal skin temperature, with the most sudden volume change as the temperature rose above 40° C. Another rather uniform observation was a plateau-like effect on the graph as the temperature rose through the 9° C. range. The only explanation here seems to be that there is a temporary inhibition or retardation of the volume increase at this temperature. We shall discuss this phase later.

Thinking that the failure to produce volume decrease (vasoconstriction?) was due chiefly to insufficient time for the cold water to induce the reflex before the temperature rose, experi-

TABLE 3—Summary of Measurement of Leg Volume Changes Resulting from the Application of Water of Constant Temperature, Ranging from about 3° C. to 47° C.

Temperature ° C.	No. of Sub.	No. of Tests	DURATION OF TESTS			VOLUME CHANGE					
			Long	Short	Average	High		Low		Average*	
45.5-47	7	12	30'	10'	21'	cc.	%	cc.	%	cc.	%
45	6	16	30'	10'	21'	130	(6)	42	(1.5)	86.5	(3.6)
40	9	19	27.5'	15'	20.5'	110	(5.7)	11	(.51)	75	(3.48)
35	7	17	20'	15'	17.1'	102	(4.51)	20	(.83)	72.5	(3.22)
30	8	10	20'	10'	15.5'	65	(3.3)	36	(1.3)	51.6	(2.28)
25	8	9	17.5'	7.5'	14.4'	56	(2.42)	20	(.82)	40.2	(1.78)
20	7	9	15'	10'	13.3'	52	(2.3)	8	(1.34)	30.9	(1.39)
15	7	7	15'	10'	13.5'	49	(2.15)	-27	(-1.2)	24	(1.06)
10	4	4	15'	10'	11.2'	40	(1.74)	0	(0.0)	22.1	(1.05)
2-4	6	6	10'	10'	10'	30	(1.55)	6	(.27)	20.5	(1.00)
						30	(1.50)	-15	(-0.685)	13.5	(0.638)

* Represented graphically in Figure 2.

Objections to the averages presented above may be made on the ground that all the graphs do not have the same time factor involved. To obtain such time factor is, of course, highly desirable theoretically, but well-nigh impossible practically. In case of hot water, it requires 20 minutes or more to approach a quantitative maximum result, while in the case of cold water much less time seems to be needed. Furthermore, the pain-factor becomes paramount. Ten minutes is all that an individual can endure at the lower temperatures and maintain the necessary quietness. In order to obtain equal time-factors, one would, therefore, be compelled to cut down the time of the hot water application to that of the cold water — namely, ten minutes, which is

ments were designed to apply at constant temperatures for definite time periods (5, 10, 15 minutes or more). The temperatures chosen ranged from 3° C. up to 47° C. The procedure was as follows: Both the temperature- and overflow-indicators were removed. The temperatures were checked with a thermometer inserted directly into the cylinder through the cylinder wall. The cylinder was filled with water at the desired temperature, the foot inserted and its volume measured by the process previously described.

The limb was kept in the bath as long as the subject could remain quiet. The lower temperature generally produced so much discomfort that ten minutes was all that could be endured at one sitting. At higher temperatures, the time could be extended to 30 minutes, in some cases, before restlessness interfered. No water was withdrawn from the cylinder until the end of the experiment. Consequently, as expansion occurred, the water rose in the cylinder causing the float to rise and the expansion indicator to move downwards on the drum. At the end of the experiment, sufficient water was withdrawn to bring the indicator back to its original starting height. The water volume thus withdrawn corresponded to the increase in the volume of the leg. In the few instances in which constriction occurred, the movement of the in-

not enough for a quantitative reaction in case of hot water. We have, however, run and recorded a few such short applications for comparative purposes. We have also tried to meet the above objections by distributing the unequal time factors fairly equally in each group; and also by graphing results obtained on a ten-minute basis as well as on a longer, or final, basis. (See Figure 4.)

Figures and data submitted in Table 3 are, of course, complete only so far as the end results are concerned. In our original records, every one of these 79 tests is represented graphically on ten different sets of graphs — each set containing all graphs obtained from the experiments at some one temperature, such as 30° C. These graphs give a clear picture of the volume changes as they progress during the entire test period. A brief summation of those graphs are submitted below:

indicator was, of course, in the opposite direction; and to correctly ascertain the extent of the constriction it was only necessary to add water to the cylinder until the indicator again rested at its starting point. The volume of the added water equalled the volume loss through vaso-constriction. Since the water in the cylinder was maintained at a constant temperature, errors due to temperature changes in the water, or in the cylinder itself, were eliminated.

Experiments were run at regular 5 degree intervals, from 10° C. to 45° C. A few experiments were run at 7° C., and several between 2° C. and 4° C. The latter experiments were generally started at about 2° C., but the temperature of the water would rise one or two degrees by the end of ten minutes due to the heat from the leg. A more extensive rise was prevented by a mild freezing mixture placed in the surrounding chamber. Attempts to maintain the temperature at 2° C. or 1° C. for the duration of the experiment required such strong freezing mixture in the outer chamber that ice formed on the inside of the cylinder walls which, of course, at once nullified the experiment. However, since water has its greatest density at 4° C., the rise in temperature from 1° C. to 4° C. certainly did not tend to augment but rather to minimize our results. Above 45° C. several runs were

made at the individual's tolerance. This would vary between 45.5° C. and 47° C., and all the experiments within that range are, therefore, grouped together, in Table 3, and Fig. 2.

In most cases there appears a sudden vasomotor reaction immediately after submersion of the foot. Generally, the reaction is one of volume increase, and may last from a few seconds to a minute and a half, in a few cases even longer. On the graph it is evidenced by a rapid, in some cases almost perpendicular, rise of the indicator. In the following discussion we have chosen to refer to this phenomenon as the "initial rise."

In group 2° C.-4° C.:—The "initial rise" was small, about 5 cc. Subsequent rate of expansion uniform throughout the test except in case of subject K. P. whose expansion was maximal in about 1 minute (about 12 cc.) after which the graph assumes a form of a wavy plateau, slowly descending until it again reaches the base line after 6 minutes. At the end of 10 minutes there is a volume loss of 15 cc.

In group 10° C.:—The "initial rise" was very small; and subsequent rate of expansion uniform throughout the entire test period, except in case of subject K. P. His initial rise lasted about 2 minutes (volume increase about 23 cc.) after which no further change was experienced during the 10 minute period.

In group 15° C.:—The "initial rise" is even less evidenced than in the previous group. Subsequent rate of expansion uniform throughout the test period except in cases K. P. and V. S. Both of these ran uniform for 6 minutes (gain about 18 cc.). In case of K. P. the expansion then more than doubled during the next 2 minutes, after which no further change was indicated; in case of V. S. a volume decrease set in, and at the end of 10 minutes the leg had returned to its original volume.

In group 20° C.:—The "initial rise" is sharp and distinct in all but one case. Volume change about 12 cc. Subsequent rate of expansion uniform throughout except in case of K. P. After 4 minutes (gain about 30 cc.) volume decrease set in; at the end of 8 minutes, the leg had returned to its original volume, and at the end of the test (15 minutes) there was a volume loss of 27 cc.

In group 25° C.:—The "initial rise" is somewhat smaller than in the previous group, about 8 cc. Subsequent rate of expansion less uniform than in the previous groups with subject K. P. again showing the greatest irregularity. The graph rises very irregularly for 6 minutes, then drops rapidly during the next minute; rises rapidly during the next 6 minutes, only to drop again during the rest of the experiment. Final gain: 26 cc.

In group 30° C.:—The "initial rise" is greater than at any lower temperature; gain about 18 cc. Three individuals, J. H., P. T. and K. P., show a distinct variation from the group. The graph of the first mentioned rises above the rest in the form of an arc of a circle; the second, P. T., remains below the rest in an almost straight line showing no "initial rise;" the last, K. P., shows a

small "initial rise," drops again to the base line within 2 minutes, and finally rises again until the end of the test (15 minutes.) The subject K. P. was run twice at this temperature as a check. This second graph is very similar to the first one in all its irregularities except one; it does not drop back to the base line during the first 2 minutes as did the former; and as a consequence the entire second graph continues considerably above the first, showing a greater gain at the end of the 15 minute test. The gain was 50 cc. while the first run gave a gain of 34 cc.

In group 35° C.:—The "initial rise" continues to increase; gain about 25 cc. The group shows no noteworthy individual variation except, perhaps, in one case, that of K. P. In this group, this subject does not vary exceptionally from the rest, but it is of interest to note that the graph shows a distinct temporary drop after about 3 minutes time, which is a perfect check on a similar irregularity shown in the two graphs from the group at 30° C.

In group 40° C.:—The "initial rise" amounts to about 35 cc. Three graphs show a distinct variation from the group: Subjects V. S., R. T. and P. T. The first shows a decrease in the rate of expansion at the end of one minute; in less than another minute, however, there is a rapid rise lasting about 6 minutes; the next 3 minutes show no change; then, an almost perpendicular rise during one minute, and finally a plateau — no change — during the next 8 minutes. R. T. gave no "initial rise," the graph being an almost straight line during the entire 25 minutes of the test. V. S. gave an "initial rise," but the rate slowed up within one minute; at the end of five minutes a drop began lasting for five minutes, then a perpendicular rise lasting but a fraction of a minute; next a slow rise for one minute; then a drop for 2 minutes; and finally a perpendicular rise at the end of the test. In this group, subject K. P. showed no marked individual variation.

In group 45° C.:—The "initial rise" appears somewhat smaller than in the previous group; gain about 25 cc. Two graphs show noteworthy variations: Subjects V. S. and K. P. V. S. gave no "initial rise"—the graph follows the base line for almost one minute; there is then a fairly rapid rise during 6 minutes; no change for about 2 minutes; then a drop for about 3 minutes; and finally no change during the last 3 minutes. K. P. again shows a sharp temporary inhibition of the rate of expansion. The graph gives a slightly descending plateau at the end of 5 minutes. The effect is brief, however, lasting but one minute.

In group 45.5° C.-47° C.:—The "initial rise" is the greatest of any group: gain about 40 cc. Subsequent rate of gain also rapid but uniform for the group, except subject K. P. who was run three times. All three graphs were widely different. One exhibits some of the irregularities mentioned in the group of 30° C.; the second graph runs true to the general character of the group; and the third rises very rapidly, showing a gain of 80 cc. in 10 minutes.

Since, so far as we know, no normal expansion curve has ever been determined, nothing can be said at present regarding the mean-

TABLE 4—Volume Changes in the foot when Surrounded by Water at the Following Temperatures.

Subject	Temperature	Time	CC. Volume Increase	% Foot and Leg Volume
W. B.	2-4 C.	20'	25	1.26
"	"	10'	18	.88
"	"	10'	30	1.50
		13.64'	24.3	0.121
"	9 C.	15'	30	1.47
"	"	10'	20/25	.96
		12.5'		1.21
"	15 C.	15'	37	1.85
"	"	15'	13	.65
"	"	15'	15	.74
		15'	21.6	1.08
"	30 C.	25'	60	2.96
"	"	15'	28	1.34
"	"	15'	50	2.41
		18.3'	46	2.23
"	45 C.	20'	55	2.96
"	"	7.5'	68	2.32
"	"	30'	85	4.06
"	"	30'	88	4.20
		21.8'	74	3.38
S. B.	2-4 C.	15'	34	1.66
"	"	7.5'	21	.97
"	"	10'	-22	-1.05
"	"	10'	22	1.10
		10.6'	13.75	0.67
"	7 C.	10'	40	1.85
"	"	15'	-6	-.28
"	"	10'	30	1.40
		11.6'	21.3	0.99
"	25 C.	15'	35	1.63
"	"	15'	46	2.10
"	"	15'	22	1.06
		15'	34.33	1.59
"	35 C.	18'	28	1.38
"	"	15'	50	2.30
		16.5'	39	1.84
"	40 C.	25'	128	6.18
"	"	20'	88	4.14
		22.5'	108	5.16
K. P.	20 C.	15'	36	1.60
"	"	15'	-27	-1.24
"	"	15'	30	1.38
		15'	13	0.58
"	30 C.	15'	34	1.50
"	"	15'	50	2.10
		15'	42	1.8
"	35 C.	15'	68	3.06
"	"	20'	50	2.16
		17.5'	59	2.61

ing of the curves as obtained. Neither can we give any reasons for the variations shown by subjects V. S. and K. P.

Having obtained such varying vasomotor reactions — both qualitative and quantitative — from our constant temperature experiments when applied to different individuals, it seemed desirable to determine, if possible, the constancy of these reactions in the same individual. Accordingly, two to four constant temperature experiments were performed on each of several individuals. Results obtained from three of the individuals are presented in Table 4. The greatest variation by one individ-

ual at the same temperature is by subject K. P. at 20° C. Duration of tests was the same, yet there was a gain of 1.6 per cent in one test, and a loss of 1.24 per cent in the other. Although subject K. P. was rather erratic in his reactions in all his tests, and as a consequence cannot be considered as typical or average, considerable individual variation can also be observed from the other two individuals.

It also seems desirable to submit data demonstrating the consecutive reactions of the individual over the entire experimental temperature range at five degree intervals. Such

data, involving four individuals, are presented in the following Table 5. The figures, of

TABLE 5 — Volume Changes in Foot When Surrounded by Water at the Following Temperatures

Subject	Temp.	Time	Volume in-crease in cc.	Volume in-crease in %
W. B.	2° C.-4° C.	10'	30	1.50
"	10	25'	23	1.14
"	17	15'	37	1.85
"	20	15'	28	1.37
"	25	15'	40	1.87
"	30	28'	60	2.90
"	35	15'	50	2.43
"	40	25'	85	4.05
"	45	30'	85	4.06
"	46	30'	88	4.20
K. P.	2° C.-4° C.	10'	-15	-.69
"	10	10'	23	1.05
"	15	15'	40	1.74
"	20	15'	36	1.60
"	25	15'	26	1.13
"	30	15'	34	1.50
"	35	20'	50	2.16
"	40	15'	70	3.05
"	45	25'	110	4.81
"	46	25'	100	4.30
S. B.	2° C.-4° C.	10'	22	1.10
"	7	10'	30	1.40
"	15	15'	20	.96
"	20	15'	32	1.50
"	25	15'	46	2.10
"	30	15'	36	1.60
"	35	15'	50	2.30
"	40	20'	88	4.10
"	45	30'	110	5.70
"	46	30'	130	6.00
H. P.	2° C.-4° C.	10'	10	.534
"	10	10'	30	1.55
"	15	15'	26	1.35
"	20	10'	23	1.17
"	25	15'	16	.82
"	30	20'	38	1.95
"	35	20'	65	3.3
"	40	25'	82	4.1
"	45	10'	58	2.9
"	46	30'	110	5.54

course, represent only the end-results, and do not indicate the courses or fluctuations in the volume changes during the experiment. In case of each individual, the difference in leg volume at the lowest temperature (4° C.) and at the highest (46° C.) may be considered the individual range. Such data are given in Table 6.

From this data we observe that the individual "ranges" vary from 1.73 to 5.01 per cent. What physiological factors may underlie such a marked variation in "ranges" is, at present, largely speculative. No doubt some or all of the following may be influential: Tonus, both

TABLE 6 — Changes (Increase) in Foot Volume When Surrounded by Water at the Limits of Skin Tolerance*

Individual	W.M.	W.B.	K.P.	H.P.	S.B.	R.T.
47° C.	4.34	4.2	4.30	5.54	6.00	2.40
2°-4° C.	0.70	1.5	-0.69	0.53	1.10	0.67
Difference or range	3.64	2.7	4.99	5.01	4.90	1.73

muscular and vaso-motor; threshold of either central or axon-reflexes; previous temperature acclimatization of the individual; vascular stasis affecting the production and accumulation of metabolites; skin sensory acuity; and pathological condition. It is true that subject R. T., exhibiting the lowest range, was least active physically; but it cannot be said that subject H. P., with the greatest range, was most active.

In Figure 4 the volume changes in cubic centimeters are graphed on a ten-minute basis as well as on final volume. The perpendicular lines indicate the total final volume change, while the distance from the base line to the short horizontal line intercepting each perpendicular, represents the volume changes induced during the first ten minutes. In some cases it will be noted that the perpendicular does not extend as far as the horizontal line. This merely signifies that there is a diminution of volume after the ten-minute period. In other words, the short horizontal line still indicates the position to which the perpendicular would have extended had the experiment been stopped at the end of ten minutes.

When the leg is subjected to alternate exposure to temperatures of 46° C. and 4° C. or slightly higher, for periods of five to ten minutes, there is considerable divergence in reaction from a single individual on different days, as shown in Figure 5. The leg expansion induced by an eight-minute submersion in water at 46° C. may be completely reduced by a submersion in water at 3° for five minutes. One would be prone to anticipate such reaction, at least qualitatively; but this particular experiment was the only one which exhibited such reaction quantitatively, while in about one-half of all the experiments such a reaction was not induced even qualitatively. In subject W. M., experiment B, the cold water actually augmented the expansion induced by the previously applied hot water. It required about 3.5 minutes for the cold water

* All figures represent volume change in per cent.

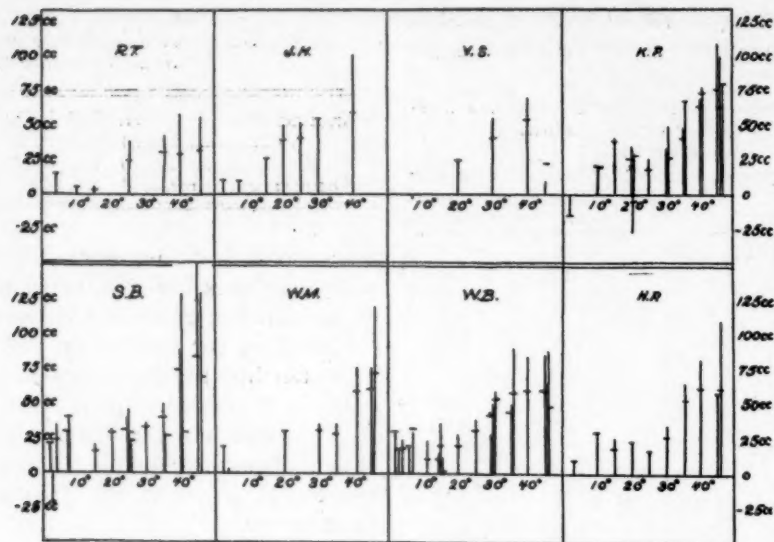


Fig. 4. Volume changes in cc. of foot and leg when surrounded by water at the temperatures indicated. The short horizontal line indicates the volume changes effected by a ten minute exposure.

to merely inhibit the progressive expansion. As the cold water was applied the second time — after the second heat application — the inhibitory effect was initiated in less than one minute, but the cold induced no constriction. As the cold water was applied for the third time — after the third heat application — the inhibitory effect was not only almost instantaneous, but it was followed by a distinct constriction.

Discussion

As previously stated, the effects of diathermy upon the motility of joints, namely, a stiffening effect, left with us the impression that the vaso-dilatory effect of diathermy was less than that of hot water or hot air. These quantitative measurements, however, show that the vasomotor (volume) effects of the three methods of heating are practically the same. The observed rigidity after diathermy may be confined to action on the striated musculature. That some relaxation of the blood vessels is evidenced after diathermy by increased temperature and active hyperemia has been noted by Friedman,⁽⁵⁾ ourselves and others.

Suggestions by Bazett⁽³⁾ lead us to make the following comparisons: Hot air, because of its poorer heat capacity and conduction power, can be tolerated by the skin at a much higher temperature than can that of water. We have in some instances applied dry air as hot as 150° C., while

the limit of hot water is about 47° C. Because of its greater heating efficiency water raises the treated part to the maximum point at a much faster rate than does hot air. Since the normal skin temperature is well below the blood temperature, the former is rapidly raised to the blood temperature through the combined effect of the water and blood. As soon as the skin and the underlying tissues attain a temperature above that of blood, the latter becomes a cooling system — and the rate of the local temperature increase is retarded. Ultimately, however, the skin and the subcutaneous tissues assume a constant temperature somewhere between that of the blood and of the water, a further increase being prevented by the cooling influence of the blood. This rise in temperature, however, produces an increased metabolism which in turn raises the tissue temperature still higher, and might, under certain conditions, raise it above that of the surrounding water. The role of the latter is then changed from a heating medium to one of cooling, and now, instead of further stimulating the metabolic processes, it actually serves to retard them.

In case of the hot air, the rise in temperature of the part treated is very much slower, to be sure, but the skin temperature as well as the locally augmented metabolic processes are not ultimately inhibited by the

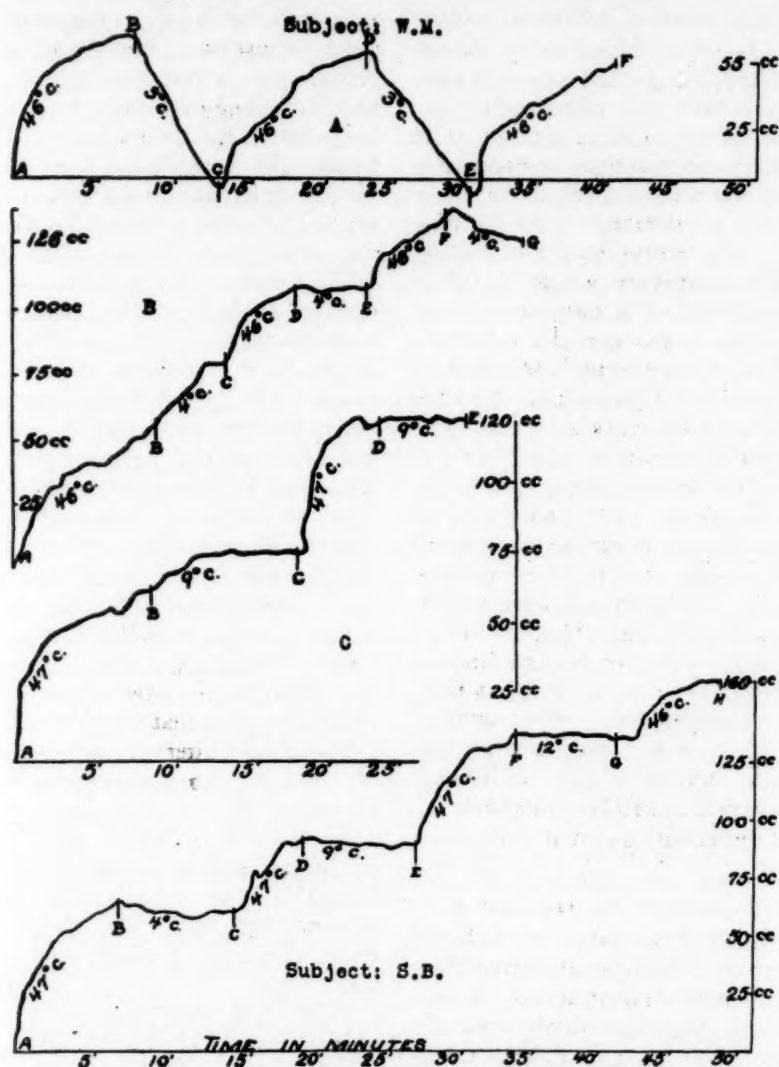


Fig. 5. Graphs of volume changes in foot and leg on alternate exposure to water at the temperatures, and time, indicated. Three experiments on subject W. M. and one on S. B.

hot air, as is the case with hot water. It may be reasoned that the comparatively small amount of heat conveyed to the part by the hot air is carried away equally fast by the blood, and that the local tissue temperature, in consequence, does not assume any higher temperature than it would with hot water. This probably occurs when the circulation is normal, but when congestion is present, the local pyrexia and consequent augmentation of metabolism is probably much greater. Some such effect is actually indicated by the much greater influence on stiffened joints by the hot air application than by either hot water or diathermy. It also conforms to the observations by

Wide⁽²⁰⁾ that a volume increase (of the arm) induced by hot air arises more slowly, but persists for a longer time, than does one induced by hot water.

From the application of water below the skin temperature a vaso-constriction or volume-decrease has been expected. Such an expectation was based primarily on the prevailing opinion and such common practices as applying cold to prevent or reduce swellings. It was more firmly established, of course, by the works of Mosso,⁽¹³⁾ and Amitin,⁽¹¹⁾ both of whom reported a diminution of volume from the application of water with a temperature below that of the normal skin. The effects obtained by

them were wholly relative, however, as evidenced by the fact that if water at 40 degrees C. was applied to the normal skin with a temperature of about 34° C., an increase in volume occurred; but if it was applied to a skin whose temperature had previously been raised to some point above 40° C. a decrease of volume occurred. Similarly, water above or below the normal skin temperature would, when applied to the normal skin, always produce an expansion when warmer, and a constriction when colder, than the skin. Only one exception is recorded by Mosso: In one case he noted an increase in volume as the temperature of the water was lowered below 10° C. This was a temporary increase only, however, and constriction again set in as the temperature descended below 8° C. This temporary volume increase was obtained by Mosso with a bath of descending temperature, and it has been verified by several of our own experiments in which we used baths with rising, as well as constant, temperatures. The graphs (Figs. 2 and 3) show not only the abrupt volume increase about 9° C., but also the wholly unexpected result of volume increases at all temperatures down to and including 3° C.

When applying water with a *rising* temperature, it might be reasoned that there was insufficient time for the cold water to produce a measurable constriction of the limb before a sensation of warmth would counteract the effect of the cold on the vasomotor mechanism. The time-period between the submersion of the limb and the first sensation of warmth was well above 30 seconds, however, and consequently of sufficient length for the manifestation of vasomotor reflexes and volume changes likely to be caused by the sudden submersion of the limb in the cold water. According to Nothnagel⁽¹⁴⁾ temperature differences of 0.6° C. may be recognized on the leg, and 0.5° C. on the instep of the foot. It is possible that this would be reduced to an even smaller fraction of a degree when such a large skin area is involved as in the present experiment, because the intensity of sensations of warmth and cold are controlled by the relative number of hot- and cold-spots involved.⁽¹⁰⁾ But the acuity of 0.5° C. as given above,

may not be true at the low temperature used by us. These observations by Nothnagel substantiate our own as to the sufficiency of time for the cold water to produce volume changes (constriction) before the water had been heated enough to give a sensation of warmth, as it would require not less than 20 second to raise the amount of water used through 0.5° C. Even though one were to apply the deduction that skin stimulation does not have to be recognized in consciousness in order to produce vasomotor response,^(9, 17, 18) and assume that such responses may actually occur before perception of warmth, it does not seem logical to us to reduce such unconscious reaction time, under these conditions, to fractions of a second. That is, the time required to initiate measureable volume-change does not, from our experiences, exceed one or two seconds as a rule; and the amount of heat imparted by the heating coils to the water during that short period would be too small to counteract and overcome the influence of the cold water.

The total absence of any volume decrease of the limb at these lower temperatures, therefore, forces the conclusion that cold water does not produce such a change. This is further substantiated by the results obtained in our experiments with constant temperature baths, in which the influence from a rise in temperature is wholly absent.

With but few exceptions, all temperatures from 3° C. to skin tolerance—usually about 46.5° C.—produce an expansion of the leg when applied locally. In general, the expansion is smallest at the lowest temperature. Two exceptions are present in most cases: A temporary amplification of the expansion in the region close to 9° C., and a diminished rate of expansion above 45° C. Mosso⁽¹³⁾ and Goldschmidt and Light,⁽⁷⁾ in two out of three experiments, noted a slight enlargement of the hand exposed to cold water. Hewlett⁽⁸⁾ observed a marked vascular dilatation on the exposure of a patient's arm to moderately cold water. However, Hewlett refers to it as "an unusual, if not, a pathological phenomenon." None of these investigators present their data in quantitative terms, i.e., in per cent, so we are unable to compare our results with theirs except qualitatively.

Practically all of the literature relating to the vasomotor effects of local applications of heat and cold, confines itself chiefly to biochemical and minute vascular phenomena and not to gross volume changes. As to the local vascular effect of heat there appears to be uniformity of results of all investigators: Warmth produces a vascular dilatation recognized through an induced surface redness, the intensity of which is increased with the temperature; all blood vessels, large and small, are enlarged, permitting a more rapid flow of the blood through the part.⁽¹⁶⁾ The larger vessels are affected chiefly through spinal reflexes or axon reflexes, and the minute vessels through a direct stimulation, or by metabolites. According to Lewis and Grant,⁽¹¹⁾ and Lewis,⁽¹²⁾ the smaller vessels are "independent both of the central nervous system and of local reflexes." That the color-changes of the skin depends chiefly on the superficial network of minute vessels, especially the venous plexus, and not upon the terminal arterioles and capillaries is asserted by Lewis,⁽¹²⁾ Carrier,⁽⁴⁾ Wetzel and Zetterman,⁽¹⁰⁾ and others.

As to the vascular effect of cold, a more varied opinion seems to prevail. The works of Amitin⁽¹⁾ and Mosso,⁽¹³⁾ in 1897 and 1889, seem to have established the prevailing view that local application of cold produces vasoconstriction and volume decrease. It is true, as previously stated, that Mosso observed a superficial vaso-dilatation and increase in volume at temperatures below 10° C., but that was only in one isolated case. According to Goldschmidt and Light,⁽⁷⁾ on exposure to cold, the skin develops hyperemia, not cyanosis. This conforms to our results. These authors also state that the hyperemia from cold does not begin to appear until the temperature of the water is lowered to 20° C. or below. Cyanosis, when present, always appears at about 20° C. or above. This, again, is in accord with our observations. According to these authors, the blue color of the skin caused by exposure to cold takes place "only at temperatures which produce vasoconstriction and decreased blood flow through the part, but which allow the continuance of oxidative processes in the tissues and an adequate dissociation of oxyhemoglobin." If by "vasoconstriction"

they mean a volume-decrease, our results indicate the opposite. Also, blueness of the skin does not necessarily indicate a general vasoconstriction. Such a color may actually indicate a dilatation of the superficial vessels and an over-filling with slow moving venous blood. In fact, this is the reaction which one is forced to assume in order to explain the constantly occurring limb expansion under those conditions. If the collecting venules and veins contract first on exposure to cold, the superficial network of minute vessels may be expanded by the increased pressure.⁽⁷⁾ The assumption that the collecting venules contract first is made on the basis that they are chilled first, as the blood enters them after having been cooled in the skin. If the tissue temperature is high enough to permit oxidative processes to go on, the net result would be local cyanosis and blue color. But this gorging of the superficial network with blood would also produce volume increase in the limb as a whole. This may, in part, furnish an explanation to the paradoxical results of vasoconstriction and volume increase. For the lower temperatures, we shall see that other factors are involved.

As the temperature of the water is lowered below 20° C., the skin color becomes more and more red, and the leg expansion becomes less and less. Just below 10° C. the leg expansion becomes in some cases proportionately greater, only to again diminish as the temperature descends below 7° C. The increased local redness is fully explained by Goldschmidt and Light⁽⁷⁾ by the local decrease of oxidative processes. Such a condition would leave arterial blood in the superficial network regardless of how slowly the blood circulated. The expansion of the leg upon exposure to the cold water we have already tried to explain, in part, by a primary constriction of the veins and venules with a consequent gorging⁽⁷⁾ of the more proximally located minute vessels. From this, one is likely to deduce that the expansion should increase with the lowering of the temperature, because such lowering would tend to intensify the venous constriction as well as the subsequent gorging effect on the proximal vessels. As previously stated, however, the expansion of the leg lessens as the temperature is lowered.

We believe the factors involved to be as follows: As the venous vessels are constricted by the cooled blood, the circulation is retarded proportionally. The blood now is exposed to a longer cooling process which in turn produces further constriction of the venous vessels, and again, further cooling of the blood. In time, when the circulation is sufficiently retarded, the cooling process begins to affect the arterial vessels as well. As long, however, as the venous constriction is not complete, the arterial vessels are still warmed by the circulating blood, and the constriction of these vessels is retarded. That is, as the temperature is lowered, the vasoconstriction on both the venous and arterial sides is intensified, but the arterial constriction always lags behind the venous. Since the arterial vessels possess a more powerful muscular structure and have more abundant nerve supply⁽²¹⁾ than the venous vessels, it seems logical to deduce that the arterial constriction, as it progresses, is more powerful than the venous. Gradually, then, the former more and more reduces the gorging effect of the latter and the volume of the leg as a whole decreases with the temperature.

The sudden temporary amplification of the leg expansion at 9 degrees C. present in some cases, demands special consideration. Two causes seem plausible: A complete constriction on the venous side would produce a sudden maximum gorging and volume increase; or a sudden paralysis of superficial network, with or without a complete venous constriction, would also produce a similar volume increase. However, as the temperature descends below 8° C. (constriction?) volume decrease again sets in. Once more, two causes seem plausible: first, the cold may begin to exercise a paralyzing influence on the constricted venous vessels; or, second, it may be causing arterial constriction powerful enough to eliminate the venous gorging. Either, or both of these conditions combined, would be sufficient, it seems, to bring about the volume decrease in question.

There is, however, another factor to be considered in relation to the leg expansion by cold, especially about 10° C. and below; namely, that of edema. Barbor and Hamilton⁽⁶⁾ present rather definite proof that the apparent increase in blood cells

produced by the exposure to cold is not an actual increase in total number of cells, but a concentration of blood cells due to the anhydremia caused by the cold. These same authors further state that such a migration of fluid is closely associated with increased capillary permeability, a constant sequel to anoxemia whether produced by cold or other means. The fluid migrates into the surrounding tissue spaces and thus contributes to the expansion of the limb. The existence of such excessive fluid to the parts exposed to cold was demonstrated by these workers. Dogs, after lying on ice for some time, would always show more fluid in the tissues of the side exposed to the cold than on the other side. Sometimes the difference in fluid content would be as great as 16:1 between the cooled and the normal sides. Some of this difference could possibly be due to gravity but no controls were run on this phase. In our own experiments gravity might play a considerable part in the accumulation of the fluid in the foot, especially at the lower temperatures. The hydrostatic pressure in the foot—even with the subject in a sitting position—would favor the accumulation of the fluid in the leg exposed to the cold. This, then, would be an additional factor in the increase in leg volume. It seems, therefore, that the unexpected leg expansion at the low temperature, especially below 10° C., is due, in part at least, to anhydremia and the resulting tissue edema.

In regard to the close relationship inferred above, between anoxemia and anhydremia, we are not convinced that anoxemia is a necessary antecedent to anhydremia. Okuneff⁽¹⁵⁾ showed that blood vessels exposed to warmth also exhibited increased permeability. This suggests that the comparatively great expansion induced by the application of warmth—accepted to be due wholly to vasodilatation—is probably, in part, also due to tissue edema.

That warmth, when applied to the skin, produces by reflex and direct action, relaxation of the blood vessels in the skin is questioned by Lewis.⁽¹²⁾ From one type of experiment he concludes that warmth increases and cold decreases the tonus of the capillaries. Lewis immersed both arms in water at 41° C. to 42° C. until a distinct hyperemia was produced; the

arms were then reimmersed: one in water at 32° C. and the other in water at 20° C., and the time noted for the hyperemia redness to disappear. He found that at 32° C. the redness disappeared after two to three minutes, while five to eight minutes were required at 20° C. The inference is that if cold causes vasoconstriction, the hyperemia should have disappeared quickest at 20° C. Lewis' interpretation of this experiment can not be accepted until limb volume measurements are made under the conditions of the experiment.

The difference in results obtained by us from those of Mosso⁽¹³⁾ and Amitin⁽¹¹⁾ may be due to the different methods employed. These workers generally placed the arm in water at temperature close to the existing skin temperature, and then gradually increased or decreased the temperature. In decreasing the temperature, for example, there was a constant and continuous irritation or stimulation of the cold spots during the entire cooling process — which in their experiments generally lasted for hours. In our own experiments, lasting from 10 minutes to 30 minutes, the limb was submerged at once into the desired temperature which was then kept constant. Since the temperature sensations are induced chiefly by *changes* in temperature, it would seem plausible that the prolonged cooling process produced a cumulative effect which differs from the effect produced by a sudden immersion into the constant temperature bath.

There are other factors present, however, which when considered make our results similar to those of Mosso and Amitin. It is only necessary to assume that those workers, after placing the arm in water at skin temperature, permitted it to remain there long enough for it to assume the volume change induced by water at that temperature. This change amounts to an increase of about 2 per cent of the original volume. At a lower temperature, such as 20° C., the increase is only about 1 per cent, and at 3° C., it is only 0.64 per cent, of the original volume. From this, one may, as did those early observers, draw the conclusion that cold produces a diminution in volume or vasoconstriction; but it should be noted that although the volume

measured at 3° C. is smaller than the one at skin temperature, the arm is still 0.64 per cent larger than it was before the original immersion at skin temperature. This would verify our own results as well as those of Mosso and Amitin. Lastly, there is the possibility that since these other workers carried out their experiments on the arms and we took our measurements on feet and ankles, that the difference in hydrostatic pressure may be a determining factor in the volume changes obtained.

Conclusion

1. The vasodilator influences, as measured by organ volume, of diathermy, hot water and hot air were found to be about equal. When applied to the foot and ankle, each produced an average increase in volume of approximately 2.5 per cent of the original volume of the limb; and when applied in immediate sequence to each other, there was an increase in volume, in all three cases, very close to 1 per cent of the original volume.

2. Evidence is brought forth which indicates that the stiffening effect of diathermy upon joints is confined chiefly, if not entirely, to the striated musculature.

3. When the foot and ankle are immersed in water at about 4° C. and the water then heated to skin tolerance, usually about 46.5° C., within a 25 minute period, there occurs a volume increase which varies considerably with the individual. In our experiments, the lowest increase was 2.8 per cent, and the largest 5.3 per cent, of the original volume. The results indicate the existence of an individual as well as a normal "expansion coefficient."

4. Water applied locally, at extreme hot temperatures, 45° C. to 47° C. produce an expansion which in general is 50 per cent, or more, complete in five minutes, and 70 per cent, or more, complete in 10 minutes.

5. While the expansion by the hot water is in progress, especially after the first five minutes, it may be retarded, inhibited, or even reversed by the application of cold water — particularly at temperatures below 10° C.

6. If, after such an inhibition by cold

water has been produced, hot water is re-applied, limb expansion is again produced with almost as great initial rate as in the first application of hot water.

7. By alternate application of hot and cold water, in a manner indicated above, a greater final expansion seems to be produced than by a continuous application of hot water alone.

8. Immersion of the foot and ankle in water at any temperature between 3° and 47° C. produces, in general, a volume increase, the increase becoming greater as the temperature is raised. One exception is noted: A marked irregularity occurs in some cases in the expansion at about 9° C. The results indicate a "critical" vasomotor reaction at, or close to, 9° C.

9. The reason our results seem to directly oppose those of earlier investigators (Mosso, and Amitin) is thought to be due to the different methods used, and to the great difference in duration of the experiments, as well as to a difference in hydrostatic pressure, as those investigators measured hands and arms, while we measured feet and ankles.

10. The volume increase induced at the lower temperatures is thought to be due to the combined effects of edema resulting from "cold anhydremia," and an expansion of the minute blood vessels. The latter in turn, being due either to a gorging effect caused by a venous constriction, or to a paralyzing action produced by the cold, or by both.

11. As the temperature of the water is lowered below 20° C., a distinct reddening of the skin occurs, the redness increasing as the temperature is lowered.

12. The conclusion drawn by Lewis⁽¹²⁾ that within moderate temperatures, cold reduces and warmth increases the tonus of the minute blood vessels appears to be erroneous.

The writer wishes to express his appreciation and hearty thanks to Professor A. J. Carlson, department of physiology, for his patient supervision and helpful criticism; to Athletic Director A. A. Stagg for his permission to conduct the experiments in the athletic training quarters; to Dr. J. B. Hoag, department of physics, for advice and counsel; and to his wife for help in compiling the report.

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THE DEVELOPMENT OF HYPERPYREXIA *

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Study of the history of artificial fever convinces one that this therapy originated in antiquity. Like many other therapeutic measures the knowledge of its beneficent action was empirical and enshrouded with magical formulas and superstitions. The laity has always been certain of the curative value of external heat. Many of us remember the hot baths followed by sweats given by parents in a laudable attempt to overcome bad colds and kindred infections of the respiratory tract. Such knowledge has been handed down from father to son, or rather from mother to daughter, for generations. Sweat baths were frequently prescribed by the general practitioner of the middle of the nineteenth century and rest on a perfectly logical basis of common sense and experience. The voluntary knowing production of artificial fever by means of physical agents and of its scientific evaluation in curing disease, is a product of the last five or six years of research. In other words, the people of the ancient, medieval and modern world have constantly employed artificial fever without realizing just what they were doing or how deep its physiologic effects were. If, therefore, we have lately become acutely aware of the value of artificial fever produced by physical means, this cannot be classed as a totally new discovery, but rather as a crystallization of long established knowledge.

History of Pyretotherapy

The Greeks were probably the first to convert their natural thermal springs into capacious baths. Several of these, administered by priest-physicians, were renowned for their curative virtues. The ancient Egyptians, Chinese and Jews advocated hot bathing, and even aboriginal tribes such as the American Indians, the Negroes of tropical Africa, and the Javanese used hot water and steam baths in the treatment of acute and chronic infections. The Romans built luxurious baths with

elaborate heating plants, some of which occupied many acres of territory, and were the meeting place and social center of Rome. Such baths were later established in all the principal cities of the empire, and continued to flourish in less ostentatious buildings throughout the dark ages.

The event of syphilis, a disease probably imported from America, made these baths more unhygienic and dangerous. The communal bath of medieval Europe was not only a place of social but venereal pleasures, and, as a consequence, of venereal infections. The spread of syphilis, which public opinion rightfully associated with these institutions, caused the bath house to fall into disrepute, and in the period that followed, personal hygiene was neglected and bodily filth became common throughout Europe. Bathing was then relegated to the wooden tubs employed in the home; not every Saturday night, but at monthly or bi-monthly intervals. Nevertheless, the knowledge of the empirical value of hot bathing persisted, especially in Finland and Russia, where many a peasant's cottage had a steam room closely adjoining the main domicile.

The Japanese were the first modern people to use intensely hot baths solely for therapeutic purposes. This was because of the natural occurrence of hot springs in conjunction with the volcanic formations of the islands. At Kusatsu water gushes out of the bases of ancient volcanoes at a temperature between 100 and 160 degrees F. The baths are given in large communal tanks about four feet deep, at a temperature between 113 and 128 degrees F. As the water flows into these reservoirs, it is unbearably hot, and the bathers stir it with large wooden paddles, thereby cooling it somewhat. They then immerse themselves to the neck and pour the hot water over their heads with wooden dippers. Thus they remain immersed for variable periods, chanting a song while the bath master shouts encouragement from time to time. After about six

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 14, 1933.
* From the Departments of Neuropsychiatry and Physical Medicine, Northwestern University Medical School.

minutes of this refined torture, they bob out almost parboiled, as one observer has stated, with a body temperature ranging between 103 and 105 degrees F. Since this temperature continues for some time after the patient has left the bath, and since these hardy people take about five baths a day, it is clear that quite a decided and persistent elevation of temperature results. These thermal springs are renowned for their curative effects on all forms of syphilis, arthritis, rheumatism, acute genital urinary infections, and respiratory, digestive, nervous and ocular diseases. The curative effects of these springs have heretofore been attributed to their high mineral content. They have been very popular throughout the empire since the sixteenth century, and enjoyed local renown for several centuries before this time.

In 1883, Philips⁽¹⁾ demonstrated that the temperature of the body could be raised to 103 degrees F. by immersing himself in hot water. He also noted an increase in the respiration and pulse rate. This extremely important observation was buried and forgotten in the pages of the *Columbus Medical Journal*, and had to be re-discovered several times before its importance was appreciated. In 1919, Weichbrodt and Jahnel⁽²⁾ used hot water for the purpose of elevating the temperature of syphilitic rabbits; Schamberg and Tseng⁽³⁾ again used the method for treating syphilis of human beings in 1927; Walinski⁽⁴⁾ used hot air in 1928; Rosanoff,⁽⁵⁾ a psychiatrist, independently revived the hot bath in 1928, and finally Mehrtens and Pouppirt⁽⁶⁾, also psychiatrists, employed it in the treatment of a number of cases of syphilis of the central nervous system in 1929. Each of these authors, with the exception of the last two, re-discovered a method which had been described by Philips in 1883. Essentially, this method consists of raising of the body temperature by means of external heat. It is noteworthy that all these investigators were interested in syphilis, and that most of them were psychiatrists. The idea of curing syphilis, especially of the central nervous system, by means of fever produced by physical modalities is, therefore, a concept which began to shape and crystallize in the thoughts of several investigators at about the same time.

Development of Electropyrrexia

Our own researches came about not as the

result of studying the almost forgotten experiments of Weichbrodt and Jahnel, and the completely buried article of Philips, but rather as a result of our own thoughts about the therapeutic problem of general paresis. It is well known that this disease is benignly affected and sometimes cured by malaria, recurrent fever and rat-bite fever. Many years ago paresis was treated by threading horse hairs under the skin of the chest of patients, and thus producing huge abscesses, and occasionally by allowing the patients to become infected with erysipelas. The injection of bacterial toxins such as tuberculin and typhoid vaccine for the purpose of ameliorating the disease is a recent discovery. Milk, suspensions of sulphur in oil, turpentine, and many different foreign proteins have also been used for this purpose. About 1925, it occurred to one of us (Neymann) that all these different therapeutic methods had one thing in common—an elevation of temperature. I was also acquainted with the fact that the diathermic current produced a sensation of warmth and probably heat within the tissues. The next thought was the possibility of passing a high frequency current through the head of a parietic, heating up the brain, and thus curing the patient. This was later proven to be impractical because it is impossible to penetrate the skull with an intense diathermic current without burning the soft tissues, and even if a slight heating of the brain should result, this heat is promptly carried off by the blood stream. Without coagulation it is only possible to produce a slight elevation of temperature and an active hyperemia by local diathermy.

In 1925, a physicist was consulted about this problem. The information was given that the diathermic current produced little, if any, heat within the tissues. Lately this fallacy has been reiterated by two physicians.⁽⁷⁾ In spite of the fact that we were told that all our ideas were faulty, we attempted to heat up the brain of dogs, and were quite unsuccessful. During the course of these experiments, we found that the body temperature of the animal increased a little, and we therefore conceived of the idea of elevating the whole body temperature by means of the passage of large amounts of current through electrodes placed on the chest, abdomen and back. In this way, electropyrrexia first came into being. Many discour-

agements and slow up-hill progress marked our efforts. The production of artificial fever in man can now be said to depend only upon two factors, proper insulation so that the heat obtained is not dispersed into the atmosphere, and proper electrodes which will allow sufficient current to flow through the patient.

Our electrodes were gradually perfected and are now well known. If proper technic is used, it is impossible to burn a patient with the diathermic method. This technic can not be learned off-hand, but must be acquired by experience. It is too complicated to warrant a description here. Essentially a good insulating bag, in which the patient is placed, and electrodes that are scalloped and fenestered, or constructed in such a manner as to prevent the edge effect of the current, are the primary requirements. Needless to say, carelessness in applying or handling the electrodes must be avoided. The electrodes are held in place by means of a canvas jacket.

Shortly after we completed our early experiments with diathermy, another group in the East conducted similar experiments with radio waves. The end result of this brilliant piece of research was the radiotherm, a machine which requires no electrodes in direct contact with the patient, but which is costly to operate and sometimes inclined to catch on fire. We have used one of these instruments for eighteen months and have come to the conclusion that in its present form it is more spectacular than practical. A little later another group of workers became interested in electric heating blankets, and reported favorable results in a group of paretics treated by enveloping the patient in such a blanket which produced fever. This type of treatment is, of course, a mere variant of the electric light cabinet method of Walinski. We became interested in the question of the effects of external heat as opposed to penetrating heat and have reported our complete findings in a recent paper.⁽⁵¹⁾ Briefly stated, our conclusions are as follows:

Effect of Electropyrexia

Hyperpyrexia can be induced by external and by penetrating heat. The hot bath is the least suitable agency for producing long sustained temperatures. It is very exhausting, and can not be used with safety without a rectal thermocouple. Electric blankets produce

temperatures slowly, and are, therefore, exhausting, although less so than hot water baths. External heat often causes an inhibition of the functioning of the sweat glands, and, therefore, is prone to upset the temperature regulating mechanism of the body. Radiothermy is less efficient and more time consuming than diathermy. Superficial burns are frequently caused by its use. Diathermy is very efficient and innocuous, but is not very suitable for exceedingly obese individuals since in these it is inclined to cause a liquifaction and a leaking out of the fat into the surrounding connective tissue. Fatty tissues seem to offer more resistance to the passage of a diathermic current than do other parts and organs of the body. For the treatment of the very obese, radiothermy and the electric blanket are our methods of choice.

Space will not permit of a discussion of the physiologic observations made during electropyrexia. A thorough understanding of these phenomena can be reached by a study of the reports of Hall and Wakefield⁽¹⁸⁾, Hinsie and Carpenter⁽⁹⁾, Knudson and Schaible⁽¹⁰⁾, Mortimer⁽¹¹⁾, Perkins⁽¹²⁾, Bishop, Ullman, Hill, and Lang⁽¹³⁾, Simpson⁽¹⁴⁾, Bierman⁽¹⁵⁾, Neymann⁽¹⁶⁾, and many others. Some of these facts will certainly be incorporated in the future textbooks of physiology.

Let us now turn our attention to the results of treatment. As has already been stated, at first therapeutic interest centered on general paresis. Here, therefore, we have the best criterion as to what may be accomplished, both from the standpoint of the number of cases and the length of time that has elapsed since treatment was completed. Table 1 gives a chronological survey of all published reports that have come to our notice. The number of cases and the therapeutic end results are also listed.

Turning our attention to this table, we find that 544 cases have been reported in the literature. Of this, 161, or approximately thirty per cent, are accredited with a complete remission, while 155, or 29 per cent, are reported as improved and are now for the most part said to be no longer in need of hospitalization. Eighteen have died as a direct result of treatment. This is approximately three per cent. Statistics of malarial therapy show that about thirty per cent achieve a remission or are greatly improved. Electropyrexia has doubled this percentage. The death

TABLE 1—CLINICAL RESULTS IN THE TREATMENT OF DEMENTIA PARALYTICA WITH ELECTROPYREXIA

Authors	No. of Complete Cases	Complete Remissions	Improved	Died as Result of Treatment
Note: Numbers in parenthesis following names of authors, refer to references which will be found at end of article.				
Neymann and Osborne (17), (18)	25	16	2	0
King and Cocke (19)	12	2	6	1
Cortesi (20)	8	3	3	0
Neymann and Koenig (21)	50	12	13	0
Perkins (22)	26	13	10	2
Wilgus and Lurie (23)	97	10	43	6
Pacheco e Silva, Passos, Fajardo and Marques de Carvalho (24)	5	1	1	0
Hinsie and Blalock (25)	68	13	24	2
Schiff, Misset and Trelles (26)	2	1	0	0
Prior (27)	16	9	3	0
Halphen, Auclair, Crozon (28)	15	4	4	0
Bamford (29)	13	1	0	0
Bishop, Horton and Warren (30)	18	13	0	1
Schamberg and Butterworth (31)	10	4	3	0
McKay, Gray and Winans (32)	28	3	15	1
Neymann, Feinberg, Markson and Osborne (33)	20	11	2	1
Epstein (34)	10	0	8	0
Graham (35)	23	12	2	1
Worthing (36)	6	1	3	0
Freeman, Fong and Rosenberg (37)	50	0	10	2
Simpson, Kislig and Sittler (38)	19	18	0	0
Schallenger (39)	4	2	1	1
Martinez (40)	4	3	0	0
Neymann further cases to date	15	9	2	0
	544	161 30%	155 29%	18 3%

rate attributed to malarial therapy varies between ten and thirty per cent. Certainly electropyrexia has decreased this death rate to a marked degree. Whenever we deal with results achieved by many different investigators in various parts of the world, we must take cognizance of the fact that the human element has a marked influence on the problem. This accounts for what at first glance would seem to be an almost irreconcilable difference when the reports of some of the individual research workers are compared. We will not allude to our own statistics, but rather consider those of Freeman, Fong and Rosenberg in contrast to those of Simpson, Kisleg and Sittler. The first group of physicians treated 50 fairly deteriorated and demented paretics with ten short hyperthermic sessions. The fever was not allowed to rise much above 104.5 degrees F. Simpson and his associates, on the other hand, treated 19 cases in the early stages of the disease with approximately twenty sessions of hyperthermia. The fever was maintained for many hours at a high plateau, ranging near 106 degrees F. Freeman and his associates report ten improvements and two deaths. The Simpson group records eighteen complete remissions and no deaths. It is hardly necessary to state that such extremes both in the type of case selected and in the

method of administering this therapy are not the rule. We believe that the sum total of all of these results warrants the conclusion that electropyrexia is one of the most valuable modern aids in the treatment of dementia paralytica.

Recent Observations of Electropyrexia

Recently reports on the treatment of tabes have appeared in the literature. Good results have been obtained by Menninger and Fellows,⁽⁴¹⁾ Epstein,⁽³⁴⁾ Schamberg and Butterworth,⁽³¹⁾ Bishop, Horton and Warren,⁽³⁰⁾ and Simpson⁽³⁸⁾. We have treated six tabetics and have noted a decided improvement in every case. Lightning pains and crises ceased after five or six hyperthermic sessions. The gait became less ataxic, and one patient was so much improved that it is no longer possible to make a diagnosis of tabes; his knee jerks which were absent can now be elicited, the pupils which reacted sluggishly to light are now normal, and the spinal fluid has become completely negative. The five other cases all showed a reduction of the cell count, a decrease of the globulin content, and of the luetic zone colloidal gold curve.

Cerebro-spinal lues is also improved by electropyrexia. Halphen, Auclair and Crozon⁽²⁸⁾, Epstein⁽³⁴⁾, Schamberg and Butterworth⁽³¹⁾, Simpson⁽³⁸⁾ and finally Martinez⁽³⁹⁾ all report encouraging results. We have treated five cases afflicted with this disease. All of them had been treated with arsenicals, mercury of bismuth, and potassium iodide without improvement before hyperpyrexia was employed. All were benefitted and one even regained partial control of his right arm which had shown a decided paresis for six months before treatment was begun.

During the past two years we have treated six cases of luetic optic atrophy at the Illinois Charitable Eye, Ear, Nose and Throat Infirmary. A minimum of twenty treatments were given each patient, with temperatures ranging above 105.8 degrees F. for four hours, and often above 107.6 degrees F. for two hours. This is truly the maximum upper limit of safety. Temperatures above 108.5 degrees F. are always dangerous. Temperatures of 107.6 degrees F. can be reached and sustained for two hours in selected, robust individuals if the maximum amount of medical attention is given during treatment. These cases of optic atrophy were all advanced when

they came under our care. All had positive spinal fluid findings. Thus far two have lost the vision they possessed and have become blind. The other four retained the remnants of their vision and two of them even show an improvement in visual acuity. Not enough time has elapsed to allow us to make deductions as to the value of hyperpyrexia in this chronic disease. Several years must elapse before we can arrive at definite conclusions. There has been a decrease of the spinal fluid cell count, globulin content and in the height of the colloidal gold curve in all four cases that have remained stationary. Perhaps electropyrrexia offers some hope to those afflicted with the incurable disease.

In a paper, which is about to be published in the *Journal of Nervous and Mental Diseases*, we have reported the results of treatment in twenty-five cases of multiple sclerosis. The mild early cases were especially benefited. There were four of these. All of them were so much improved that they can be said to be in remission. The eleven advanced cases were also improved. Two of them achieved remissions, three others regained a satisfactory control of their lower extremities, the remaining six were somewhat improved. The far advanced cases, of which there were ten, were decidedly less benefited. Six were bedridden before treatment was begun. Nevertheless one of these is now able to walk, and another with a complete quadriplegia is able to use her arms. Of the ten far advanced cases, two are much improved and four have been somewhat relieved. All in all, eighty-four per cent showed more or less improvement after hyperpyrexia. Two patients died, one as a result of treatment. Schmidt⁽⁴²⁾ states that he has treated 77 cases of multiple sclerosis. He also affirms that those who are treated early show the best results, and states that some of his cases have achieved a complete remission. Now it is a well known fact that multiple sclerosis is a disease which has a natural remission rate of about forty per cent if the patient is observed over a period of years. However, we feel that the results we have witnessed can not be accounted for by this natural tendency of the disease. The remissions occur with too great regularity in conjunction with the treatment, and in some cases, they are so astounding that the careful investigator must feel that something more has happened than would ordinarily en-

sue during the natural course of the disease.

Arthritis has been successfully treated by Markson and Osborne⁽⁴³⁾. Ten cases of the chronic infectious type were treated with long sustained temperatures, ranging between 105 and 106 degrees F. Complete relief was reported in four cases, while three were greatly improved. Nine further cases, treated with lower temperatures maintained for a shorter period gave much poorer results, since only five obtained some relief for periods lasting up to a maximum of three months. Bishop, Horton and Warren⁽³⁰⁾ have reported on fifteen unselected cases of chronic arthritis and rheumatism. Without giving statistics, they state that their results are excellent. Tenney⁽⁴⁴⁾ has treated 63 cases, and reports complete relief in seven cases, while forty-eight were improved. Auclair is also favorably impressed by the treatment.

Feinberg, Osborne and Afremow,^{(45), (46)} and Feinberg, Osborne and Steinberg⁽⁴⁷⁾ have treated 42 patients suffering from intractable asthma with electropyrrexia. Fifty-one per cent had a complete remission, varying from several days to nine and one-half months. Twenty-nine per cent were improved, without remissions. They conclude that fever therapy is a method of obtaining relief in some cases of intractable asthma in which all other methods have heretofore failed. Leopold and Stewart⁽⁴⁸⁾ reported on seven cases, but achieved no amelioration of the disease or its symptoms. The same number of cases were treated by Miller and Piness⁽⁴⁹⁾, who obtained some slight improvement. Since it is evident from a perusal of their original articles that the last four authors named had not mastered the method of sustaining the fever for any appreciable time, these negative results only point the way towards a more thorough investigation of the subject. We are probably again dealing with a pure human element, as has been pointed out in the treatment of dementia paralytica.

If we use the same kind of reasoning that was first employed by us when we originated electropyrrexia, we must come to the conclusion that the diseases, which have shown favorable results are all of one type. They are afebrile diseases, or at least conditions which show a minimum amount of thermic reaction. It is probable that fever mobilizes certain defense mechanisms of the body, and allows them to act more efficiently than they do at

normal temperatures. It is also probable that fever has some direct inhibiting action on the growth and development of the invading organisms. Bessemans and Thiry⁽⁵⁰⁾ have shown that the treponema pallidum is destroyed in human chancres and secondary lesions by a temperature of forty-one degrees C., maintained for two hours. Other pathogenic organisms are probably affected in like manner. Finally, the intense changes of the circulatory system, that accompany fever, especially the dilatation of the capillaries, must have far-reaching physiologic effects. All this points the way towards more intensive work and a more thorough investigation of the subject. We hope that the future may give us a better understanding of the further value of electropyrrexia. Enough has been accomplished to make us feel certain that a new era in therapeutics is at hand.

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EXPERIENCES WITH HYPERPYREXIA BY DIATHERMY *

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Fever has long been a thing of dread to the medical profession. It will be recalled that Virchow described alarming changes in the viscera which he ascribed to fever, such as cloudy swelling, kidney damage, and even amyloid degeneration. Since his time the physician has been at great trouble to combat fever. We are just now emerging from an era of antipyretics. As recently as 1908, MacCallum⁽¹⁾ pointed out that fever is probably a beneficial reaction. Von

Jauregg noted the improvement in paretics which followed intercurrent febrile diseases and began to inoculate patients with malaria in 1917. We are therefore arriving at a more sensible, biological interpretation of fever; instead of striving to reduce the height of fevers, we are seeking methods by which we may safely raise the body temperature. Many workers are adding to the testimony of the beneficial effects of this fever which we have feared. Excellent references may be found in recent articles

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by Neymann and his co-workers,⁽²⁾ Mehrtens and Pouppirt,⁽³⁾ Tenney,⁽⁴⁾ Mortimer,⁽⁵⁾ King,⁽⁶⁾ and others.

The work here reported was inspired by the first experiments done by Neymann and Osborne and covers a period of four years. A total of 207 patients has been treated for a variety of conditions, but a number of these have had inadequate treatment and will not be included in this report. Our results are presented in the hope that they may shed further light on the physiological pathology of fever. Never before has the physician had so exact and controllable a method of producing fever, without the introduction of variables such as foreign protein, vaccines or plasmodia. It is a unique experience in medicine to prescribe a fever and to predict exactly the form of curve which will be plotted for that fever from beginning to end.

Physiological Effects of Hyperpyrexia by Diathermy

The physiological effects of hyperpyrexia produced by diathermy vary with the height, the duration, the degree of hydration of the patient, and especially with the nature of the disease treated. Dosage factors are far from settled, and clinical controls are still too few to permit generalizations. More questions have arisen than have been answered, and these are a challenge to the thinking physician.

Temperatures produced: A rise of temperature may be produced in any subject by means of diathermy to any degree which is safe for him. Insulation against heat loss, plus an influx of current sufficient to produce more heat than is lost are the two essentials of success. Thin, muscular individuals usually require a higher current dosage than fat ones. Adipose tissue acts both as extra heat insulation and added resistance to the current, and thus makes for a more rapid rise and slower loss of heat. The heat regulating mechanism is less efficient in some patients than in others, and hence there are more variations in the fevers induced in patients who have some disturbance of the central nervous system. Such patients may undergo an abnormally rapid rise or a prolongation of temperature. The degree of hydration of the tissues seems to alter the rate of temperature rise in the same patient at different times, the

rise being more rapid if insufficient fluids have been taken before treatment. The average range of maximum fever produced in this series has been 104.5 to 106 degrees F., though temperatures as high as 108 degrees F. have been observed. Some paretics have been subjected to maxima of 107 degrees F. for as long as four hours.

Circulatory changes: Hyperemia is the most striking change seen in the patient who undergoes a fever produced by diathermy. The skin capillaries are dilated, capillary pulsation usually appears at the height of the fever, and every inch of skin surface is suffused and moist. The pulse rate increases in proportion to the rise of temperature; in this series the average increase is from 5 to 9 beats per minute per degree Fahrenheit.

The blood pressure response is variable, but the pulse pressure is always increased. The systolic pressure usually rises at the beginning of the fever, then declines, varying between 80 and 120 mm. The diastolic pressure drops very early after onset of the temperature rise, and usually ranges about 50 to 60 mm., though it may drop so low that pulsations are heard down to zero. Wiggers and Orias⁽⁷⁾ have reported marked increase in the systolic pressures of dogs treated by radiotherapy, but we have failed to find such a rise in clinical patients. Wiggers and Orias also have found that there are no significant changes in the electrocardiographic readings in dogs until the temperature reaches critical heights. The R-T interval is abbreviated and there is a decrease in voltage of the ventricular deflections.

Occasional changes in the circulation during fever are of importance. The usual red suffusion of all skin surfaces has in a few instances given place to a dusky, reddish cyanosis at the height of the fever or after the beginning of the drop in temperature. This occurs rather rapidly and is a warning of impending circulatory collapse. The pulse rate may not slow perceptibly, and may even quicken for a time. It is advisable to stop the treatment, cool the patient with luke-warm or cool sponging, and to administer caffein-sodium-benzoate, or similar drugs. Cold sponges cause vasoconstriction, slow perspiration and may increase the deeper body temperature for a

time. We have not had recourse to cold enemas. A paling of the areas about the mouth, chin and upper neck may occur at any stage of treatment. This may be followed by restlessness, an increase of pulse rate and symptoms of shock, or may disappear without subsequent symptoms.

Dilatation of the heart has been observed in two paretic patients, both of whom had prior evidence of some myocardial damage. In both cases this acute dilatation was preceded by slight cyanosis, the pulse rate slowed from about 130 beats per minute down to about 60, and the quality changed from a full bounding type to a thready, soft pulsation in a few seconds. During this phase the heart borders were found by percussion to have extended toward the left a measurable distance beyond the prior marking. Restorative measures brought about an increase in pulse rate, and with this the cardiac borders returned more slowly to their former diameters.

Respiration: Respiratory exchange must increase with the rise in general metabolism during fever. The respiratory rate becomes more rapid, the expansion fuller at first, later more shallow, with sighing and yawning at the height of the fever. The rate varies from 20 to 30 per minute for temperatures about 105 degrees F. A sudden increase in respiratory rate may indicate nervousness or an impending partial collapse, though respiratory decompensation is not common. In such an event cooling, removal of restraints and respiratory stimulants will usually suffice. We have used inhalations of ammonia and carbon dioxide and small injections of adrenalin and "coramine." Artificial respiration may be applied, but is rarely necessary.

Excretion and fluid loss: Each patient will lose from three to five pounds of weight in fluids excreted as perspiration during an average treatment. This fluid loss is decreased when atropin or scopolamin are given with the sedative, and suppression of the perspiration causes a more rapid rise of temperature through lessened heat loss via the sweat glands, and by evaporation. Fluids may be given during the fever, but there is a marked tendency to nausea and vomiting if they are given in any volume. This has led us to restrict fluids during treatment. We depend upon forced fluids

before and after the fever to replenish fluid losses, and give hot water or weak tea sparingly during the seance. Kidney function is stimulated sometimes during the first phase of treatment, but there is later a concentration of urine by diminution of excretion via the kidneys. The pH is usually shifted toward the acid side.

Blood chemistry changes: The changes in blood chemistry are chiefly concentration phenomena, and will justify further study. Mortimer⁽⁵⁾ found, in an experimental study on dogs, that the blood calcium, non-protein nitrogen and total solids increased after hyperpyrexia. The chlorides dropped or stayed at the same level, while the CO₂ combining power decreased. Neymann and Osborne⁽⁶⁾ found essentially the same changes in a patient who underwent 10 hyperpyrexia treatments. They observed the greatest variation in blood chlorides, and the uric acid concentration rose almost 1 milligram per 100 c.c. after each fever. All these changes were temporary, returning to normal levels within a few hours.

Studies have been made on five patients in this series, and have served to verify the above mentioned findings. The blood urea nitrogen increased 11 to 14 per cent, the non-protein nitrogen 9 to 10 per cent, and the blood sugar in three patients rose by an average of 16 per cent. All these values returned to normal levels within 48 hours. The changes are probably the result of blood concentration through fluid loss, plus the heightened metabolic rate during fever. In no case did the concentration of nitrogenous products in the blood stream rise to dangerous levels, though this could easily occur in case of too high, prolonged, or frequently repeated fevers. History of former kidney damage or a nephritis are contraindications to hyperpyrexia.

Blood cell changes: The first effect on the formed elements of the blood is concentration, an increase in number of both red and white cells. Leucocytosis occurs at the height of the fever, with usually a high polymorphonuclear count and a relative decrease in lymphocytes and monocytes. Staff cells appear in greater numbers with this leucocytosis. Increases of 4,000 to 5,000 white cells are common, and we have often seen the leucocyte count doubled at the peak of the fever, with the poly-

morphonuclear cells increased from normal percentages up to 80 to 86 per cent. The number of white cells decreases with the fall in temperature, but there is usually a residual increase above the original white count of 500 to 2,000 cells, which persists sometimes for several days. This is most commonly observed in cases of infectious arthritis or gonorrhea. The higher percentage of polymorphonuclear cells may persist for a few days to several weeks. Two cases of atrophic arthritis treated over a year ago still show white counts of more than double the average figures prior to treatment.

The number of red cells rises during the fever, and is higher at the termination than at the height of the temperature. Increases vary from 200,000 to 1.5 million per cu. mm., and usually drop back to normal values within two to five days. Three patients have shown persistently high red cell counts of 5.6 to 6 million and hemoglobin percentages of 110 per cent or more for periods of three to five months, after having had varying degrees of secondary anemia. Two of these patients were arthritic, one was a case of multiple sclerosis of long standing. In all these instances of marked increase of red cells we have observed occasional nucleated red cells (normoblasts) and reticulocytes, together with a mild degree of anisocytosis and poikilocytosis.

These observations, though rather isolated, suggest that hyperpyrexia is a stimulus to the hemopoietic function of all the blood-forming tissues, and that there is also an immediate mobilization of reserve leucocytes which is greatest at the height of the fever. The entire problem of blood cell changes in the presence of this "sterile" fever requires more study, particularly in those patients who are affected by such low grade infections as arthritis. Hinsie and Carpenter⁽¹³⁾ and Tenney⁽⁴⁾ have made observations which our studies apparently verify. Tenney found that the viscosity of the blood dropped as a rule, but rose in four cases from whom fluids were withheld. The latter also described a more rapid sedimentation during and after fever.

Clinical Observations

The diseases of the central nervous system, particularly paresis, have occupied

most of the attention of workers with pyretotherapy. Other diseases which are not self-limited have received some study, particularly arthritis, asthma, and gonorrhea. Sutton⁽⁹⁾ has suggested that chorea may be successfully treated with fever and has used vaccines for that purpose. It may well be that some diseases which are febrile in their nature, but which are characterized by low peaks and a prolonged course, might be effectively treated by fever produced by physical means. One such case is reported below, a case of undulant fever successfully treated by hyperpyrexia.

Paresis: Most of the paretics which we have treated have been referred because they could not undergo malarial therapy or had failed to become inoculated with the plasmodium. Fourteen patients have received a sufficient number of treatments to merit a report. Treatments have been given twice a week, at a maximum of 105 to 107 degrees F. for varying lengths of time up to 5 hours. None has received less than eight treatments nor more than twenty. Five have gone into full remission, though one of this number died of coronary disease six months after the last fever. Three cases are markedly improved and are under home care only. Two of the remaining six have improved in memory and orientation, but have not recovered sufficiently to be away from institutional care; the other four have continued to deteriorate. Most of these patients had been on antiluetic management prior to treatment. Several were given tryparsamide in conjunction with their fevers, with some apparent improvement afterward. There have been no deaths in this series. We believe that the fever maxima might have been prolonged to good effect, and it is our impression that a maximum of 107 degrees F. of two hours duration is as effective as twice that time at 105 degrees F. The most promising cases are those which are not far advanced.

Bishop, Horton and Warren⁽¹³⁾ have reported a high percentage of improvement in the gold sol, protein and cell counts of the spinal fluid in paretics treated by hyperpyrexia, though the spinal fluid Wassermann tests were not correlated with the clinical improvement. The gold sol curves in most of the cases here reported have shown a tendency to flattening of the first

portion, with a shift of the peak to the right, but only three cases have shown a negative colloidal gold curve. Protein and cells in the spinal fluid became normal in seven cases, improved in three, unchanged in four.

Tabes: Improvement has followed the adoption of high peak temperatures in treatment. One with tabetic crises was completely relieved by four seances with fevers of 106 degrees F. Two have improved sufficiently to carry on their own work, one has remained stationary, and one has grown rapidly worse. Of the five cases, the last showed the most deterioration before treatment. The degree of improvement seems to be governed to a large extent by the amount of damage already done to the cord prior to treatment, and is not predictable.

Multiple sclerosis: Seven cases of multiple sclerosis have received hyperpyrexia treatments, and of these, four have shown marked improvement. Two of the improved cases are in full remission, the other two have some residual muscle spasm, ataxia and weakness. One patient improved markedly for two months after a series of six treatments, then rapidly regressed, and has failed to improve with later treatment, so he is classed as unimproved. Halphen⁽¹⁰⁾ has reported some excellent work with this and other diseases of the central nervous system, but we feel that there is not sufficient evidence at hand to judge of final results in multiple sclerosis. Hyperpyrexia does however offer definite promise of amelioration of symptoms and possible remission in many cases, especially if treated early.

Myelo-encephalitis: One case of myelo-encephalitis was given five fever treatments of temperatures of 105 degrees F. each, and was markedly relieved of severe, constant headache, of eye-muscle paresis, and spasm of the neck muscles. Reflexes became less marked. The improvement lasted six weeks, when the headaches began to recur, and sufficient time has not elapsed to allow evaluation of the final result.

Parkinson's syndrome, post-encephalitic type: Encephalitis lethargica leaves residues which are sometimes more difficult to deal with than the acute phases of the disease. Temporary improvement of several weeks or months in five of eight cases treated was

observed, but none of these has shown any permanent change for the better. Two advanced cases became markedly worse during treatment, while one mild case has remained unchanged. This report is contrary to the results recorded by Mehrtens and Pouppirt,⁽³⁾ though the earlier cases of this small series have been observed over three years. It may be that a change in dosage factors might be followed by better results.

Gonorrhea: Striking results have followed hyperpyrexia treatment of gonorrhea, both acute and chronic. At first only the complications were treated, such as vesiculitis, epididymitis, cervicitis and gonorrheal arthritis. Contrary to our expectations, the results were uniformly good in every case. Treatment of cases of sub-acute and chronic urethritis was next attempted, with almost as good results. A total of 45 cases have been treated at peaks of 105 to 106 degrees F., lasting two to three hours. Every case has had thorough urological management throughout, and all cases treated have remained clinically cured to date. The larger number of these patients were treated through the courtesy and with the cooperation of Dr. F. F. South, of Portland.

Ten cases of gonorrheal arthritis have been treated. Every one of these has been relieved of joint pain, swelling and loss of function. This includes one which was complicated by an acute salpingitis; both local and general symptoms cleared up after five treatments. Six of these patients had had foreign protein injections and specific vaccine before hyperpyrexia was applied.

The findings in the urethral smears following fever treatment merit description. The discharge becomes profuse on the first day after the first fever treatment, regardless of whether or not there has been an active discharge. This exudate is full of pus cells and intra-cellular diplococci. The organisms become fewer and the discharge less each day, but both reappear in large amount after the second treatment. This time the organisms stain poorly, there are more extra-cellular cocci, and many pus cells are fragmented. The discharge almost or completely disappears in one to three days after the second treatment, and smears show a few extra-cellular cocci or none. The third fever may be followed by a re-appearance of pus cells and a few extra-

cellular organisms, which soon disappear, or there may be no discharge and the smears become negative. The same sequence of events follows treatment of a chronic cervicitis, or of a prostatic abscess. In the latter case, the abscess may rupture into the urethra, but the smears remain positive over a longer period.

The observations made in gonorrheal cases alone would merit a complete paper, and much detail must be left untouched. Tenney⁽⁴⁾ has been using radiotherapy as a source of fever, and states that radiotherapy is almost specific for gonorrhea. Boak, Carpenter and Mucci⁽¹⁴⁾ found that temperatures ranging from 40 to 42 degrees C. (104 to 107.6 degrees F.) destroyed forty-eight hour cultures of *N. gonorrhea*. The clinical results reported here suggest that some of the organisms must have been killed, certainly others must have been attenuated, and we may assume that immune reactions are intensified and hastened. The acute local inflammatory reaction which is produced by the fever also tends toward a more complete regression as this subsides.

We are not unaware of the pitfalls which one may encounter in the treatment of gonorrhea by any measures. Had our series been more extensive, we should undoubtedly have had some bad results or failures to report. The cases of gonorrheal arthritis mentioned were all early, with the first 3 to 12 weeks. Cases of longer standing, with extensive destruction in the joints, might be arrested, but complete cessation of pain and return of function could hardly be hoped for.

Infectious arthritis: Infectious arthritis seems to offer the best prognosis under fever therapy of all types of arthritis treated other than the gonorrheal arthritis mentioned. All focal infection is eradicated wherever possible before the hyperpyrexia is begun. No part of the general medical management may be omitted in these cases, and the fever produced should be above 104 degrees F. for at least two to four hours. We have given fever treatment every third or fourth day, maxima of 105 degrees F. for periods of two to four days or more. Less intense fevers give some palliative results, but are not so effective. The number of treatments given depends on the individ-

ual reaction, never less than six in a series. The course of fevers is repeated after an interval of one to three months, whether joint pains have recurred or not, or sooner in case of earlier return of pain. A great deal of patience is necessary in the use of this measure, as with all other methods of treatment of any arthritis.

Dosage factors have been suggested by Neymann, et al.,⁽²⁾ Bierman,⁽¹²⁾ Tenney⁽⁴⁾ and King,⁽⁶⁾ but the work is too new to permit of final conclusions as to optimum height of fever, number of treatments, duration or even of prognosis. All the authors quoted mention the relief of muscle and joint pains, and report quite uniform improvement in function. We have noted an increase of pain during the rise of temperature in many patients, the pain usually disappearing after the temperature reaches fever heights. This relief may last a few hours to several days after a single treatment. Patients who exhibit less joint destruction experience earlier and more complete relief than those of long standing with destructive joint changes.

Two cases of acute rheumatic iritis with mild joint symptoms were treated with three fevers each, maximum of 105 degrees F. Improvement might be listed as about 60 per cent, with a corresponding shortening of the duration of both the iritis and joint pains. More systematic work with this condition is justified by theory and these suggestive results; possibly higher maxima would give more complete relief.

Chronic arthritis: Chronic rheumatoid arthritis, hypertrophic and atrophic types are all classed under the head of chronic arthritis for the sake of convenience. These cases are usually poorly adapted to the rather strenuous treatment of hyperpyrexia. Degenerative changes which are commonly present in the vascular system, heart and kidneys, add to the risk of fever treatment. We have found that low temperatures of 101 to 103 degrees F. for one to four hours often give marked relief from joint pain, stiffness and muscle spasm and make possible an increased range of joint motion. Every patient treated has noted relief from coldness of the extremities, and skin temperature tests before and after prolonged low fevers have shown lasting increases of from one to three degrees in per-

ipheral skin temperatures. With this improvement there is a change in skin texture and color toward the normal, and the tissues are less tense, pale and clammy. The degree of pain relief seems to be in inverse proportion to the amount of pathological change in the joints. All these patients have gained weight and strength after a series of treatments, none has been completely and permanently relieved of joint symptoms, but all have experienced some degree of relief.

We may conclude that infectious arthritis is most often benefited by hyperpyrexia, used in conjunction with removal of focal infections and medical treatment. The chronic forms of arthritis are sometimes materially improved by fever treatment, and an occasional case will show surprising relief of all symptoms with only a few, low-maximum fevers. No detail of the usual medical regime may be or need be omitted in the care of these cases.

Undulant fever due to Bacillus Abortus: One case of undulant fever was referred for treatment after three months of intermittent, low-grade fever, ranging from subnormal in the forenoons to 101 to 102 degrees F. in the afternoons. Agglutination for *M. Melitensis* was positive. One treatment of 105.5 degrees F. for two and one-half hours was followed in a few days by complete cessation of malaise, weakness and fever.

Clinical Observations

Some clinical observations made during this work over a period of four years may be of sufficient importance to warrant brief mention. Herpes labialis has been seen in over fifty per cent of all patients treated. This may be mild or very extensive, and is usually more marked in patients who are somewhat debilitated before treatment. The herpes usually appears in 10 to 24 hours after the first fever, and may localize along the lip margins or spread over the entire chin and upper lip. The second treatment is usually followed by rapid disappearance of the lesions, though occasionally there is an exacerbation. Herpes is seldom seen after the third or fourth treatment, and there seems to be no relation between the height of the fever produced and the appearance of herpes.

Tertiary syphilides have been observed

on the legs and arms of two cases of paresis after high temperatures. These are annular, smooth, crusting lesions, 1 to 2 cm. in diameter, with dark brown, crusted centers, surrounded by a zone of light yellow appearance and a peripheral area of hyperemia. Never more than three or four have appeared, and they have never been of long duration, usually healing by the third or fourth treatment with very little scar. These were seen in patients who had had thorough treatment with tryparsamide and other arsenicals plus bismuth.

Prolongation of the fever after the normal maximum and after discontinuance of the diathermy has been noted in a number of patients, notably in two types. Patients with some disturbance of the central system, particularly multiple sclerosis, have frequently continued to run a temperature for several hours. The same response has occurred in patients with acute gonorrheal infections, particularly in the presence of a prostatitis or salpingitis, or in gonorrhoeal arthritis. This has been interpreted as a natural response to the stimulus of the fever, or to an imbalance of the heat regulatory mechanism. No attempt has been made to shorten this prolonged fever, which has never lasted more than six to ten hours after the plotted maximum.

Psychic disturbances have been common, taking the form of a mild delirium as a rule. This appears at or just before the fastigium, and usually persists throughout the maximum part of the curve. Mental patients may become greatly disturbed, the form of the disturbance depending on the type of the psychosis. Restraints are only necessary with the latter cases. A quiet, reassuring attitude on the part of the nurse in charge will often suffice to keep the patient from becoming too restless.

Sedatives are usually used, since there is marked discomfort during the phase between 101 degrees F. and the maximum. Morphine sulphate in sixth or quarter-grain doses has been most commonly used. This is sometimes re-enforced by scopolamine, 1/160th to 1/200th grain when a rapid rise and a prolongation of the fever are desired. This drug stops perspiration and blocks heat loss through formation of sweat and evaporation. The disadvantage of scopolamine is the occurrence of abnormal reac-

tions, either too deep a sedation with depression of the respiratory center or stimulation and a more marked delirium. The barbiturates, bromides and chloral hydrate all have been tried, but none has proven satisfactory except as an addition to the morphia late in the course of the fever. We have followed Bishop's⁽¹³⁾ suggestion of large doses of chloral with some success, but have discarded it as a routine.

Technic

We have used cuff electrodes for the past three years with satisfactory results, though both the body electrodes and the quadruple cuffs have been used in this work, with rubber sheets and blankets or a special "sleeping bag" arrangement for heat insulation. The milliamperage with the cuff technic has been from 750 to 1200 ma., and from 3800 to 4000 ma. with the body electrodes. Details of the technic are extremely important to good results, and time will not permit of their full discussion here. Recently Dr. Kimble and Mr. Holmquest have developed an original and unusual type of metal-rubber⁽¹⁵⁾ composition electrode which is an improvement over the foil cuffs. Temperatures are taken by mouth and axilla every 15 minutes, or preferably by a rectal thermophore which may be left in place.

Conclusions

1. Fever temperatures within any range compatible with the safety of the patient can be produced at will by diathermy.
2. Hyperemia due to dilatation of the peripheral capillaries is general. All tissues of the body are heated to nearly the maximum.
3. Blood chemistry changes indicate chiefly concentration phenomena, due to loss of fluids.
4. Leucocytes are increased in number, with a relative high percentage of polymorphonuclear and staff cells at the height of the fever. The increase in white cells may persist at a high level for several weeks after hyperpyrexia in cases of infectious type.
5. Increases in the number of red cells, with occasional nucleated red cells and reticulocytes have been seen after a series of hyperpyrexia treatments.
6. Clinical results have been reported in

a varied group of diseases. The greatest percentage of cures has been secured in the treatment of gonorrhea and gonorrheal arthritis. Infectious arthritis cases are benefited in the majority of instances. Remissions in general paresis have been as frequent as with the malarial form of fever therapy. Late results in post-encephalitic Parkinsonism have been poor. The chronic arthritic has received palliation of symptoms only.

7. Additional work is needed to establish the optimum temperatures, time and frequency of hyperpyrexia treatments. Care in selection of cases is essential.

8. Fevers produced by the diathermy method are less dangerous than those produced by foreign protein, because they are more controllable.

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Discussion

On Papers by Dr. Neymann, Mr. Osborne and Dr. Jones.

Dr. William Bierman (New York): There are so many considerations involved in these reports that one hesitates to discuss any. Possibly a few deductions may be drawn from these presentations of general interest to all. One is that the entire situation is in a state of flux, which is natural in any new therapy. No definite conclusion has been reached unanimously by all the workers as to what constitutes the most efficient machine for this purpose. There are and will be controversies possibly for a few years more until we discover some mechanism which is either an improvement over the technics we now employ, or some entirely new technic to produce an elevation of body temperature by means of physical agencies. Dr. Neymann and I have indulged in differences of opinion occasionally as to the comparative values of diathermy and radiothermy. I haven't convinced him and he hasn't convinced me, and thus we stand. I have been using radiothermy with good results, he diathermy. The important conclusion we may draw from these papers is that we have an exceedingly important new therapeutic procedure. Whether there will be an agreement as to the value of this measure in the treatment of various diseases or not, all workers are definitely agreed that in certain conditions this measure appears to closely approach the ideal, particularly in the diseases due to the few organisms which may be affected and can be affected directly by heat, that is, infections due to the diplococcus of Neisser, and the spirocheta pallida.

There is agreement, too, that in the treatment of other conditions, such as infectious arthritis, multiple sclerosis, and a number of other conditions some of which have been mentioned, this measure is also of great value.

Emphasis should be laid, too, on something to which Dr. Simpson called our attention yesterday, that the important consideration is an able, complete, comprehensive medical review of the situation as judged by a man specially trained for such observation, namely, a capable doctor. That is and must always remain the major consideration. But given such an individual, and exercising good clinical judgment with reference to the diseases which he treats and to the status of the patient as he goes through this procedure, which is obviously not simple because it is fraught with danger if carelessly administered, and given an able assistant, the measure is a safe one.

I have been very much impressed, and I think we all have been with the great thoroughness with which this field is being investigated. It is reasonable, therefore, to be cautious in making assertions as to the value of therapy in various diseases, and the excellent laboratory investigations which have been made in the effort to reach an exact knowledge of the physiologic changes in order that we may still more logically apply our knowledge of

these changes and our previous knowledge of the pathology of the various diseases treated for the greatest benefit of ailing mankind.

Dr. Paul Roth (Battle Creek, Mich.): There is one fundamental fact which should be borne in mind in the discussion of hyperpyrexia, and that is if we wish to understand it we must know the physiological effects of heat. Any function of the body which tends to upset the normal temperature of the body, induces at once in the organism a series of actions and reactions which we now recognize as protective and highly beneficial, at least when controlled within certain limits. It is no more nor less than a supreme effort on the part of the living organism to safeguard the very existence of the organism.

This physiologic induced action is fundamentally a wise one and, as I stated, a protective one. Not so many years ago the therapist did his best not only to subdue this effort of nature, but to even prevent it as completely as possible. We now know better. We know that fever is a natural process in a body and should be encouraged in many, induced in some, and regulated in most cases.

The electric light bath, which is one of the procedures which has been discussed this morning as a means of producing hyperpyrexia, was introduced in 1886. I was a nurse then, and being at the Battle Creek Sanatorium naturally was taught all the technic in the administration of the electric light bath. We were told then the temperature of patients should be watched very carefully, and if it rose above 101 degrees F. it was an indication that the treatment should be discontinued immediately.

Now we are seeking the administration of this and various other procedures in which we favor the raising of body temperature much more than this. It is not a harmless procedure. We must recognize the fact that to raise the temperature of the body as high as we are at present throws a tremendous burden on the organism. It is true that a considerable degree of toxicity is induced in the body as a result of that. Nevertheless, we are inclined to do it because the final result will be greater, more beneficial than the harm which may be done as evidenced by certain symptoms which may develop during the administration of the bath.

I wish to call your attention particularly to the anoxemia which may be the result of the treatment, and which so far has, I believe, been quite ignored. This anoxemia, I believe, is of a kind which has recently been recognized, and is a fourth type of anoxemia. Barcroft has recognized three types and lately a fourth type has been added. It is called histoxic or psychotoxic type of anoxemia.

My observations in the administration of this form of treatment, the electric light cabinet, as well as diathermy, leads me to believe that in cases in which we impose a prolonged high temperature in the body we are in the presence of a histoxic type of anoxemia. We have administered oxygen during this more severe period of the treatment with very good results; not al-

ways spectacular, but quite often spectacular in the results. This histoxic anoxemia is very similar to or is the one which is encountered in anoxemia due to gas poisoning, or to any condition which induces an accumulation of toxins in the body, as in alcoholism, the use of narcotics, and so forth. We find in these cases a liberal amount of oxygen in the blood, even increased under the influence of prolonged heat. But that increase of oxygen in the blood does not necessarily mean that the body is in a better condition. It means that this increase is due to the fact that the tissue cells, because of intoxication, are unable to make use in an adequate way of the liberal amount of oxygen which is then circulating in the blood. It is what happens in alcoholism and other substances of like nature.

This is a field we should study whenever we want to impose this form of therapy upon our patient. On the whole, it is a beneficial process provided it is properly controlled and provided we take measures to avoid or to diminish the untoward symptoms, and this anoxemia I believe is one of them.

Dr. Walter Simpson (Dayton, Ohio): At the expense of some repetition which some of you may have heard in my discussion yesterday, I would like to give my impression of these discussions on hyperpyrexia. The first emphasis appears to be on apparatus, and it is my conviction that the last emphasis should be on apparatus and the first on the physician. The second emphasis should be on the thoroughly trained nurse-technician, and last, and of least importance, is the kind of apparatus that may be used for the induction of the fever.

Dr. Neymann spoke at some length on the selection of patients. I would put that as the next important consideration. Any results that we may have achieved have been due to our careful study of patients. We accept no patient until he has been subjected by us to a complete diagnostic survey.

There are distinct contraindications to sustained high temperatures. The first I believe to be old age. A patient of sixty-plus is a risk under any consideration. One who has evidence of myocardial or renal insufficiency is a distinct risk. One who has dementia paralytica, in the demented phase, is a distinct risk, and one invites disaster by accepting such a patient for this form of therapy. Other contraindications we have observed, because of our general ignorance rather than on the basis of any knowledge, are the presence of active tuberculosis, extreme cases of hypertension in which thrombotic manifestations have already occurred, and so forth. In other words, clinical judgment by the physician is the first essential.

As regards the case of arthritis, a report of our experience, with well over 100 cases of infectious arthritis, would correspond almost exactly with the report by Markson and Osborne. I have nothing to add to that except to say that we have run the whole gamut from one treatment to ten treatments, and at the present time we feel

that two treatments, two weeks apart, with fever sustained between 104 and 105 degrees F. for five hours, is productive of as good results as a greater number of treatments. The interesting thing is that the maximum improvement appears to occur four to six to eight weeks after the first fever treatment.

In regard to the neurosyphilis cases, the euphoric agitated type of patient is almost certain to get a good result. The demented patient with a rapid course is almost certain to get a bad result. Because of the fact that our best results have been obtained in cases of asymptomatic neolues, we were led to believe that perhaps this form of therapy should be applied to early lues, and for the past several months we have engaged in an investigation which has three phases.

The first is the combination of sustained fever with specific therapy. In the second group, specific therapy of the same type and amount without fever; and third, fever alone. We have secured considerable evidence which leads us to believe that the combination of fever therapy plus specific therapy in fresh syphilis, by which I mean the primary and secondary stages, constitutes a valuable method for the treatment of this disease. The best application of this form of treatment will not be to treat these disastrous late effects, but to prevent them.

Our observations as regards gonococcal arthritis have been the same as those mentioned, uniform success. I am glad **Dr. Jones** spoke about gonococcal infections. I was afraid it might be left out entirely. In cases of gonococcal urethritis and gonococcal salpingitis we have encountered the same results as reported by **Dr. Jones**. We are now experimenting with a combined form of treatment in which we elevate the general temperature and by use of the Elliott apparatus elevate the pelvic temperature, the water temperature starting at 115, going to 130, and then dropping back to 120 degrees F. and maintaining the water temperature at that level. I assume you are familiar with the Elliott apparatus, and I will not bother to describe it. In men, the same form of treatment can be carried out if one substitutes for the vaginal applicator the rectal applicator.

As regards the treatment of late lues, I think there is abundant evidence to indicate that one should combine specific therapy with fever therapy. The advantage here over malaria is that one can carry out a sandwich treatment of specific therapy, fever, and not interrupt the fever course as one does when one gives an arsenical during the course of malaria fever.

Some mention has been made of the use of saline solutions. I mention this because **Dr. Jones** suggested that we restrict fluids. I think this would be a fatal error. We know the patient is losing an enormous amount of fluid. Furthermore, we know the greatest loss in that sweat is saline. If the patient is subjected to five or more hours of sustained fever, he loses more saline in his sweat than he has normally in his blood. In other words, he is withdrawing it from his cells. Therefore, the patient is saline

hungry. For that reason, we have used from four to five liters of a 0.6 per cent saline solution throughout the course of the treatment. This has enormously improved the condition of our patients as regards nausea, vomiting, abdominal cramps, muscular twitchings, sense of exhaustion, fatigue, and so forth. Those have been largely eliminated. It is perfectly apparent that most of these symptoms are due to hypochloremia which should be combated.

We are by no means convinced that the apparatus we have used is a good one. It has been therapeutically successful, but any success we may have attained has been due to the fact that we have an engineer working with us day and night. We are attempting to develop a simpler apparatus. We feel we are on the track for one quite different than anything now being used, but we are ready to abandon it when anybody else comes along with one that is better.

Realizing that the biggest hurdle has already been crossed, it is now demonstrated beyond doubt that electropyrexia is here to stay, and it will occupy a very important place in therapeutics. But I think the most important consideration during the state of investigation is to maintain an open mind.

Dr. Nathan H. Polmer (New Orleans, La.): The problem that confronts us in this symposium is whether physically induced hyperpyrexia by any of the accepted names or methods, be it hot air, hot cabinets, hot water, hot plates, hot blankets, hot baths; be it conductive heat, convective heat, or convective heat; be it diathermy, radiothermy, hyperthermy, or pyretotherapy, the question still is: Will all or each of these methods produce clinical results?

All roads lead to Rome, the ancients would tell us, and from the papers and discussions this morning one would judge that each of the adequately induced, properly controlled hyperpyrexia treatments will lead to a certain measure of therapeutic success in selected cases of paresis, infectious and probably other forms of arthritis, intractable asthma, chorea, multiple sclerosis, and a few other conditions.

Many of us have given hyperpyrexia treatments. Most of us have observed them given by several of the popular methods, but the lesson to carry away with us is that therapeutic fever induced by physical measures is of distinct advantage in the treatment of a number of conditions. Those conditions in which satisfactory results have been achieved were reported to us here. The physiological and biochemical changes induced by hyperpyrexia have and are being studied, and it is interesting to note that the observations fairly well coincide.

Physically induced hyperpyrexia will, no doubt, be used in an increasing number of conditions as a helpful adjunct to treatment, but here a similar condition exists as in ultraviolet treatment. When one is asked today, after all the years of ultraviolet light therapy, "What conditions will ultraviolet radiation cure?" We can answer in the light of our present knowledge, "Ultraviolet radiation will only cure rickets, infantile tetany, and spasmophilia, but it is of great value as an adjunct in many other diseases and conditions."

Similarly, when an advanced stage in the evaluation of the place of hyperpyrexia is reached, we may find the specific therapeutic properties limited to but a very few conditions, but like ultraviolet irradiation it may be of help in a wide variety of pathological conditions. There is no one best method of inducing therapeutic fever.

Few of us are so fortunate as to be in research institutions where all methods are available. Therefore, each of us when he goes home and when the occasion arises will use that method which he has available with which he has had experience, and until the light of further observation is thrown upon the best method he will use the method with which he gets results.

Personally, my experience has been limited to diathermy hyperpyrexia, and this is the method I shall continue to use until a better, a safer, an easier and more economical method has been decided on, or until my institution has these other methods available.

Finally, I wish to emphasize that this is certainly not a method of treatment for the tyro. Hyperpyrexia, in my opinion, means adequate diagnosis, hospital treatment, and a great responsibility on the physician administering it as well as proper and adequate nursing supervision.

Dr. William Schmidt (Philadelphia): It is important that one or two points be emphasized in connection with pyretotherapy. The first, I think, is that this work is entirely a hospital procedure. The second thing that ought to be emphasized is that the cases should be very carefully selected, not only because of the danger but because there are certain conditions that it is useless to treat, cases which are far advanced. Where the condition is in such a chronic state that there is no hope of doing anything for them, it is very foolish to subject the patient to the treatment. In cases of nervous disease, where there is advanced degeneration, you cannot expect to produce in them new nerve tissue.

It should also be emphasized that men who expect to do this work, or who are trying to do it, should familiarize themselves with the methods of treating the various complications that arise, because these complications sometimes come on very quickly and require very energetic and prompt treatment in order to save the patient's life in many instances.

As far as apparatus is concerned, there has been a great deal of talk about the multiplicity of apparatus used. Personally, I think it is a good thing, because we need experience with all these various apparatus that have been offered to us in order that we may determine the best method that will elevate the body temperature safely and with the greatest ease to the patient, and because these treatments are certainly not easy for the patient to take. When we can obtain a method which will do this work properly, it will become the accepted method without any further discussion.

I have had experience with diathermy as a

method for producing sustained fever; also the cabinet for hyperpyrexia. I found that the latter method was a little easier on the patients; they liked it better. The results were equally as good, and I have had no great difficulty as sometimes found with diathermy.

I am at present using an apparatus which atomizes hot water to successfully elevate body temperature. I have another piece of apparatus which is being perfected that works on another principle. All these methods will be tried out, and eventually I will arrive at some method which will be economical, safe, and easy for the patient to take.

Dr. Arthur C. Jones (closing): I want to call your attention to one thing which I neglected to mention, and that is adrenalin when administered as a restorative is only indicated where there is cardiac dilatation. Otherwise, it is contraindicated, as the contraindication of real cold sponging, which I feel increases the temperature for a time.

The field of hyperpyrexia, contrary to Polmer's discussion, is wider than he may think or perhaps any of us may think, because fever is certainly a natural physiological defense mechanism and is one which is of universal occurrence. I feel there should be no stopping of the intensive research on this subject, which certainly should be in the hands of trained men, cautious men, men who will study their cases prior to treatment, and who will carry through a thorough study of each case.

I was very glad to hear Dr. Simpson say that he insists upon a complete work-up of his patients before he even attempts hyperpyrexia, because I have had one or two sad experiences through failing to do so, and have now instituted that same method.

The contraindications have been very sketchily mentioned and I feel might bear at least naming through. Some of these are through merely inference and not through knowledge, as Dr. Simpson suggested. I feel certain, from what we know of the pathology and histology of tuberculosis, that it is a definite contraindication. I feel also that hypertensive cardiovascular-renal diseases, or any other degenerative type of ailment which involves the vascular system is surely a contraindication. All my experience points

that way. Other cardiac lesions of severe degree are also contraindications to the fever treatment. Hyperthyroidism, from my own experience, has been a very definite contraindication, and surely diabetics and others might be mentioned.

As one goes through his studies of fever, he certainly can be guided by his own clinical experience and judgment in the selection of patients. Perhaps there are many other contraindications. It is fortunate for us who are working in this field that it is rather a formidable thing to create a temperature in a human being. That is one of the protections which I think we should strive to maintain in all this work with fever, and hold it within bounds of good, solid, logical thinking.

Dr. Clarence A. Neymann (closing): Perhaps it might not be amiss to elaborate on the data presented in the body of our treatise. We began our experiments of creating artificial fever in man by means of the diathermic current on May 15, 1928. On May 29th, 1928 we achieved a rise of one degree Fahrenheit in a human subject at Northwestern University Medical School. Unbeknown to us Mr. Lloyd Call, engineer of the General Electric X-ray Corporation, to whom we had disclosed our ideas of raising the temperature of the brain of paretics in 1925, recorded similar observations, a rise of .6 of a degree of Fahrenheit, in an experiment conducted on himself on May 19, 1928. During the entire summer of 1928 we continued our experiments on human subjects and dogs. This work culminated with the solution of the problem of properly constructed electrodes for hairy non-perspiring mammals and for man. A summary of this work which first made electropyrrexia possible appeared in the *Illinois Medical Journal*, September 1st, 1929. It also included our first work with general paresis. As far as we have been able to ascertain, this is the first publication on this subject.

I wish to stress the remarks of Dr. Bierman and Dr. Simpson. What we really need is not so much apparatus and new technic, but scientific investigators; physicians who are capable of using the various machines and gauging their physiologic effects, as well as their action on disease. I wish to thank all the participants of this symposium for their constructive and highly intellectual contributions to this important new realm of medicine.



ELECTROPYREXIA IN CHRONIC INFECTIOUS ARTHRITIS *

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CHICAGO

In the selection of patients for treatment by hyperpyrexia, we now exclude the hypertrophic group of arthritis entirely. This type is synonymous with degenerative, senescent and osteo-arthritis, now regarded as an arthrosis to distinguish it from the inflammatory lesions of the joints, or the arthritides. The joint lesions are considered as only a single manifestation of the general senescent, degenerative changes taking place in other tissues. We have collected considerable data to show that marked degenerative changes co-exist in the heart, the kidneys, and the arteries of these individuals to a much greater extent than in non-arthritis patients of the same age and type.

In spite of the theoretical and clinical objections to treating such patients with hyperpyrexia, we were persuaded to try it out on four patients. In each instance, we were forced to terminate treatment abruptly and institute restorative measures. One of these patients showed signs of myocardial failure, another began to show an auricular fibrillation, still another showed signs of vasomotor collapse, while the fourth developed an acute delirium.

Etiology of Infectious Arthritis

Because of such experiences we now select only cases of infectious arthritis for hyperpyrexia treatments as they represent the younger arthritics whose cardio-vascular systems are better able to withstand the strain of treatment. Although infectious (proliferative,⁽¹⁾ atrophic, rheumatoid, arthritis deformans) arthritis patients present many of the features of a chronic infection, such as temperature, leucocytosis, mild anemia, loss of weight and muscle atrophy and tone, yet the exact cause is still obscure in spite of the mass of bacteriologic evidence presented by many investigators. In a general way, the bacteriologic theories as to its causation has two groups of supporters: those who believe

that the germs are carried through the blood stream to the joint tissues where growth takes place; and those who believe the bacterial products to which the patient becomes sensitive, are responsible for the joint manifestations. Dawson,⁽²⁾ Lichtman,⁽³⁾ and others have presented convincing evidence against the former conclusion, while the latter needs considerable confirmation before it can be accepted. Many other factors have been suggested as playing an etiologic rôle, such as endocrine disturbances, vitamin deficiencies, trauma, hereditary predisposition, yet, in the light of our present knowledge, we must consider infectious arthritis as having a complex etiology, with many different factors playing some rôle in each individual case. With this broad viewpoint in mind, the problem, we believe, belongs in the realm of internal medicine.

Despite the uncertain etiology of chronic arthritis, considerable evidence has accumulated to prove that an inefficient capillary circulation is a definite factor in the evolution of this disease.⁽⁴⁾ Wright and Pemberton⁽⁵⁾ have devised tests which demonstrated this lowered surface temperature, the decreased blood flow, and the lessened ability on the part of tissues to adjust themselves to changing temperatures in cases of infectious arthritis. Direct capillary studies⁽⁶⁾ in these same patients showed a narrowing and closure of the capillaries resulting in irregular and intermittent flow, and a sluggish response to such vasodilators as erythraltetranitrate, histamine, and heat. As a corollary to this evidence, much of the modern therapy in arthritis has as its basis the increase of the blood flow, the increase of tissue metabolism and temperature of the joints involved. The methods having this objective are many: non-specific protein therapy, massage, exercises, postural correction, hydrotherapy, electrotherapy, vasodilator drugs, and sympathectomy.

The experience of Neymann and Osborne⁽⁷⁾ with electropyrexa in the treatment of paresis led us to believe we had a safe, easily

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⁽¹⁾ From the Department of Internal Medicine, Arthritis Clinic, and the Department of Physical Therapy, Northwestern University Medical School.

controllable method by which we could produce a prolonged vasodilatation with heat alone as the agent. Our preliminary report of sustained heat treatment of six cases appeared in the *Illinois Medical Journal*, November, 1931.⁽⁸⁾ More recently Merriman and Osborne⁽⁹⁾ have reported their studies of various methods of producing fever wherein the advantages of diathermic hyperpyrexia were clearly demonstrated. Our report therefore, deals with a larger group of cases treated by diathermy, producing a sustained fever above 104 degrees F. during a period of from six to eight hours. A series of eight treatments constituted a course. The treatments were given in a hospital under the careful supervision of an experienced nurse. The patient entered the hospital the night before, receiving a light breakfast at eight o'clock in the next morning and then treatment.

Technic

A high frequency current generator of ample capacity is of prime importance. The generator used by us is capable of delivering ten amperes under a load, and gives opportunity to treat two patients simultaneously.

The desired temperature is reached through heat insulation. This is a very essential factor for the successful maintenance of the fever over a number of hours. The use of a heat insulating treatment bag makes this very simple and effective. The treatment bag is opened and placed over the mattress, the electrodes are properly applied and carefully fixed and the patient is wrapped in two layers of bath blankets to absorb the perspiration. Special care is given to insulation of the region of the shoulders and neck where there is the greatest likelihood of heat loss. The entire bag is then closed by means of a hookless fastening arrangement (zipper type). There is a suitable opening for the electrode leads, and the thermometer readings. The patient is entirely enclosed with the shoulders and neck thoroughly insulated from heat loss no matter how restless he or she may become. The advantage of this waterproofed bag is that it can be washed after use without damage. A recording or registering thermometer shown in Figure 1 is the type used; however, an ordinary rectal thermometer can be used in an emergency.

We feel that the electrode application is of sufficient importance to be given in detail. With the patient in a sitting position the en-

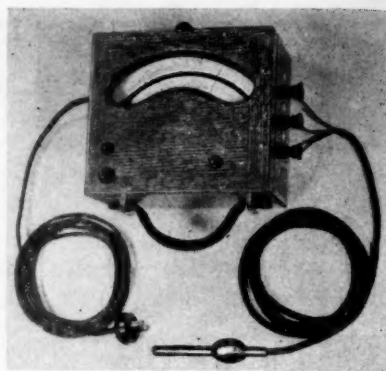


Fig. 1. Electric Thermometer for taking rectal temperatures during fever treatment, etc.

tire trunk is anointed with a conduction lubricant. Then the Neymann fenestrated electrodes are applied, so that the upper border is at about the level of the second or third dorsal vertebrae, with the jacket placed over the electrodes low enough not to chafe under the axilla. Now the patient lies down, and, if necessary, the jacket is straightened out under the buttocks. The chest electrode is next applied but not moulded to conform to the contours of the trunk; in fact, the hands play no part at all in shaping the electrodes. This is accomplished entirely by means of the retaining canvass jacket which is first laced evenly down the front and finally down each side. When this is carefully done, the electrodes will conform well to the shape of the trunk without uneven pressure at the edges, which is quite often the cause of the so-called "hot spots." We have recently devised a new electrode technic which still further insures safety and comfort to the patient and practically eliminates these pressure areas. A three-inch electrode encircles the trunk at the waist level, while similar electrodes encircle each thigh and leg. These five leads are plugged into a special jack with marked inserts from which suitable cords make connection with the high frequency machine. This new method is particularly valuable in patients with marked deformity of the back and chest where such deformity interferes with the proper moulding of the larger jacket electrodes.

Recent investigations with conducting lubricants⁽¹⁰⁾ have shown that many of them are unsuitable for high frequency conductivity and may account for many of the so-called "scalds" that occur. As a result of this study a new conducting jelly is now available that still further insures against such accident.

The amount and duration of the current flow varies with the individual. Ordinarily, we use from thirty-six hundred to six thousand milliamperes, four thousand being the average. Our objective is to maintain the temperature at 104 degrees F. for eight continuous hours; however, only one or two hours of the current application is required to reach this height. At the end of the eight hour period the patient is uncovered and allowed to cool until the rectal temperature drops to 100 degrees F., at which point a tepid sponge bath is given and the patient placed in a freshly prepared bed. The time required for the entire procedure is approximately twelve hours.

Reactions and Laboratory Data

The best guides to the patient's condition during the treatment are the pulse rate, the systolic pressure and the patient's color. A pulse rate above 160, a sudden fall in the systolic pressure, or a marked facial or circumoral pallor indicate impending circulatory failure, which makes it imperative that the treatment be immediately discontinued and the temperature brought down to normal as quickly as possible. Usually the systolic pressure remains normal or is slightly increased and is therefore a more reliable indicator of circulatory efficiency than the diastolic pressure, which drops 30 to 40 mms. of mercury without producing any distressing symptoms. Since we have adopted the routine use of morphine to control the restlessness there is decidedly less variation noted in the diastolic pressure. The fluid loss through perspiration amounts to three or four liters and contains approximately 18 to 24 gms. of chloride. The chloride deficit probably accounts for the muscle cramps and the vomiting that occurs during the height of the fever. As suggested by Simpson⁽¹¹⁾ we now attempt to replace the chloride loss by adding 6 gms. of sodium chloride to each liter of water. Another peculiar reaction occurring in patients treated with vaccines is a chilly sensation or, in some cases, a severe chill that lasts several minutes. We now avoid this by discontinuing other treatment for at least one week before hospital entry. The fever curve in arthritis patients is also quite characteristic, the mouth temperature crosses and recrosses the rectal temperature but the normal relationship between the two is re-established as the fever rises.

There is no variation from normal in the opsonic index, agglutinins, or complement content.⁽¹²⁾ The leucocytes are markedly increased at the height of the curve with a relative increase in polymorphonuclear cells. The erythrocytes are increased as is the hemoglobin. Dehydration partly accounts for these findings, but stimulation of the bone marrow, as evidenced by the increase in the staff cells,⁽¹³⁾ may play a rôle. The tendency of the eosinophils to disappear as the fever rises, has no adequate explanation. Sedimentation rates⁽¹⁴⁾ taken after the treatments are completed corresponds with clinical improvement.

Microscopic studies of the nail-bed capillaries show, during the fever, an increase in the size, the number, and in the rate of blood flow. There are also increased skin temperature readings as well as oscilometer readings of the deep circulation.⁽¹⁵⁾

A method of plethysmographic studies of the peripheral vascular circulation has been described by Johnson, Scupham and Gilbert.⁽¹⁶⁾ The same authors have kindly permitted us to use material from an unpublished paper dealing with vascular changes during hyperpyrexia induced by various agents. Using 25 million typhoid intravenously there is produced a marked depression of the capillary circulation with a secondary rise, which is much less than in other methods. Hot water heat, electric light cabinets, infrared, increase the volume change, but apparently less than does diathermic hyperpyrexia. Accepting this index as criterion for vascular dilatation, the diathermic method would seem to be definitely superior to all other agents tried.

Blood chemical analysis shows an increase in the urea, nonprotein nitrogen, and uric acid, which is accounted for by concentration. The blood chlorides show no change or a slight decrease, indicating that there is a shift from blood to tissues due to the concentration of approximately ten per cent.⁽¹¹⁾ About 18 to 24 gms. of sodium chloride are lost at each treatment, and a definite decline in the chloride content of the gastric secretion is noted.⁽¹¹⁾ There appear to be discrepancies on the blood ph. and alkali reserve by different workers. Mortimer⁽¹⁷⁾ reports a definite decrease of the plasma CO₂ in both man and dogs. Bischoff,⁽¹⁸⁾ reporting on the CO₂ combining power on human subjects, noted no change or a slight increase in the alkali re-

serve. Feinberg,⁽¹⁹⁾ in seventy-four determinations, did *not* observe any increase in CO₂ combining power of the blood with high fever, although three cases showed an increase of ten per cent by volume. He also noted that alkalization of the patients previous to hyperthermia increased the CO₂ combining power before treatment, but during the fever it returned to normal. Blood lactic acid determinations on a series of our cases, at various points of the fever curve, showed no variation from the normal.

Clinical Results

Nine cases received a full course of eight treatments with prolonged hyperpyrexia. All in this group have been under observation from one to two years since we completed one course, and have been checked up at frequent intervals. The last survey made on May 3, 1933, showed the following: One had complete relief from symptoms for fifteen months; another for twenty-one months; two for twenty months; no other treatment having been used in the interim. Three of the group remained improved for periods of twelve to fourteen months but had some recurrence of decidedly less intensity than before treatment began. In all, seven, or 70 per cent were improved from one year to twenty months. The length of these remissions, we believe, is convincing evidence of the value of this type of therapy in spite of the small number of cases treated.

At the suggestion of Dr. Coulter we also tried sustained fever curves of shorter duration, using such agents as radiant heat, hot water baths, diathermy, and blankets. The results of such shorter curves, although not comparable to the well sustained groups, are sufficiently encouraging to warrant their continued trial.

Nine cases, Group II, were treated with the short curve method, the courses varying from six to twelve treatments. Five of this group were definitely improved, with remissions of three months or longer. Three of this group were improved for only one month and are included in the group with no improvement. The percentage of improved cases is therefore 56.

In addition, nineteen treatments were given to five patients in Group I and fourteen to four patients in Group II, making a total of one hundred and eighty-eight treatments given to twenty-eight different patients with-

out a single serious reaction. This speaks well for the safety of the method provided ordinary care is used.

Other authors have reported good results in the treatment of arthritis by hyperpyrexia. Bishop, Horton and Warren⁽²¹⁾ had excellent results with fifteen unselected cases. Tenney,⁽¹⁵⁾ using radiotherapy on sixty-three arthritic cases reported seven symptom free, forty-eight markedly improved, and eight unimproved. Fifty-five, or 87 per cent were definitely improved for a period of eight months. Auclair, Emery and Weil⁽²²⁾ are enthusiastic proponents of this therapy in the treatment of rheumatism, arthritis and gout. Cecil⁽²³⁾ states that his results are disappointing, but mentions the fact that in some cases the results are permanent.

Comment

Diathermic hyperpyrexia is now accepted, both in this country and abroad, as a valuable new addition to the therapy of infectious arthritis. The clinical results presented above are gratifying, particularly when the severity of the treated cases is considered. In explanation, it should be stated that these patients were treated in many clinics over prolonged periods of time without any decided improvement and therefore served as excellent controls for fever therapy.

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Discussion

Dr. William Bierman (New York): With reference to hyperpyrexia in the treatment of arthritis, we should be particularly cautious regarding the claims of superior clinical effects in the light of our limited knowledge regarding this disease. In many respects arthritis is still the complex problem that it has been, and while our knowledge has increased considerably we are still in ignorance concerning many of the major factors, particularly those related to its etiology. The trend

of opinion appears to be that the primary causative factor in arthritis is of bacterial origin, in all probability a variety of streptococcus. Since the heat resistance of streptococcus is much above that which is maximum for hyperpyrexia treatment the favorable effects must be explained on some basis other than a thermolethal action on this organism. We are not in complete accord with some of the findings reported in this discussion particularly with reference to the serologic changes. We have studied these changes in animals protected against typhoid bacilli, streptococci, staphylococci and diphtheroid bacillus. We noticed a diminution in the complement fixation titer of the blood serum. With reference to the sedimentation test—when the sedimentation rate has been rapid before treatment it has slowed up afterward. We have found an increase in both the phosphorus and lactic acid content of the blood following the development of hyperpyrexia. The results following the application of hyperpyrexia for the treatment of gonorrheal arthritis have been remarkable. It appears as if hyperpyrexia acts in a specific manner in exerting a thermolethal effect upon the Neisserian organism. In a consideration of infectious arthritis, however, we must look for effects other than thermal, such as, for example, the influence of hyperpyrexia upon the velocity of blood flow, blood pressure and other physiologic changes. The induction of temperature elevation in the treatment of arthritis will take its place along with other therapeutic measures—medicinal, dietetic, bacterial and physical.

Dr. D. E. Markson (closing): Our impression is that electropyrexia is a new method for the treatment of arthritis, and that it is a valuable method provided care is taken with the technic. In the series of cases presented, we have shown that some have remained well as long as twenty-two months, and that is considered very good in arthritis and speaks well for this particular type of therapy.

In regard to the immunologic changes, this data was secured and quoted from the Department of Alexander Day. We didn't find any particular change. He preferred to report all the changes in agglutinins, opsonic index, or complement content as being within the range of normal. Work on nitric acid was done by Dr. Fishback, Department of Pathology, with new set-up and apparatus. We checked the lactic acid before the beginning of treatment and various points in the curve, and the day following treatment. At no point in the curve did we find any change in lactic acid according to the set-up we had.

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THE TREATMENT OF "CARDIOSPASM" *

With Notes on Diagnosis and Etiology

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Normally, the lower end of the esophagus remains closed except at the approach of a bolus of food — but then, after a very brief delay, it opens and allows the bolus to pass into the stomach. It is the condition in which we are confronted with a dysfunction of this mechanism that I wish to discuss. This condition has long been best known as "cardiospasm"; it has been called "achalasia" by Hurst, and "preventriculosis" by Chevalier Jackson. "Cardiospasm" is a term that Jackson and others find unsatisfactory because they feel that the lesion is neither at the cardia nor spasmodic. Hurst's term "achalasia," which means "failure to relax," is a good one and deserves consideration. The term "preventriculosis" has the merit of describing the condition without attempting to explain its etiology or pathology, which are not yet fully understood. Many other terms have been suggested, but time does not permit their discussion here. Perhaps the future will offer a better term than any of those now in use, but the first thing is to agree on the characteristics of the clinical entity we are discussing, and its diagnostic proofs.

Definition

The condition may be defined as a stenosis of the lower end of the esophagus which is primarily functional, but which is often complicated in the later stages by organic stenosis, and is always accompanied by more or less dilatation of the esophagus, if of more than a few months' duration.

Diagnosis

The diagnosis of cardiospasm may be suggested by the symptoms of regurgitation, a feeling of heaviness or pain in the chest after eating, or various other symptoms; though patients often present a history that is misleading, and a symptom complex that is atypical. Very often the patient does not mention dysphagia among his complaints, and the esophagus is not thought of as the site of the lesion. Patients often have the impression that they swallow satisfactorily, yet complain

of "vomiting," which is in such cases regurgitation from a dilated esophagus, of food that has never reached the stomach. In cases where a diagnosis of preventriculosis is suggested by the symptoms or thought of by an alert physician, this diagnosis may be further substantiated by a typical roentgen ray appearance, i. e., a more or less dilated esophagus with obstruction to the passage of the opaque mixture out of the esophagus into the stomach, the lower end of the esophagus showing a smooth, generally conical outline terminating at, just above, or just below the apparent level of the diaphragm.

Though the diagnosis of this condition can be made correctly in a majority of cases by the experienced roentgenologist, we wish to emphasize the fact that esophagoscopy is absolutely necessary to confirm it, and especially to exclude carcinoma of the extreme lower end of the esophagus. We have had a number of cases in which the diagnosis of carcinoma was made esophagoscopically, though the roentgen-ray appearances were those of preventriculosis. Youth of the patient is no proof that the lesion is not carcinoma. We have seen carcinoma of the esophagus in a girl 17 years of age, and a number of times in patients under thirty. Occasionally a cicatricial stenosis following peptic ulcer of the lower esophagus will simulate preventriculosis. In one patient such a stenosis had caused a complete atresia of the lower esophagus, requiring gastrostomy. In this case it was eventually possible to perforate the atresia, dilate the stenosed esophagus, and completely restore swallowing by mouth. The patient had none of the symptoms or signs of preventriculosis after the cicatricial stenosis was dilated.

Etiology

Some writers have regarded sex as an important etiologic factor, though they have not all agreed as to which sex was the more frequently affected! In our last fifty cases, males predominated; there were twenty-seven males

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 13, 1934.

and twenty-three females. As for age of onset of symptoms, the disorder very often has its beginning in adolescence, though the average age of onset in our last fifty patients was thirty-seven years. The condition has been reported in infants, and in quite a number of our patients it dated from about the age of puberty; on the other hand, it has been known to come on in old age.

When asked regarding their own ideas of what brought on their trouble, patients almost invariably give some psychic or emotional explanation. They quite often attribute it to worry over financial affairs, domestic difficulties, fright, or other excitement. Among the questions asked in a questionnaire recently sent out were the questions: "What do you think brought on your trouble?" and "If it is worse at times, what seems to make it worse?" In answering these questions forty out of fifty patients gave "nerves," "excitement," "worry," "aggravation," "fright," "anger" or "disappointment" as either an exciting or a perpetuating cause. Seven gave "fatigue," "overwork," or "lack of sleep."

Other causes to which patients have attributed the onset of their trouble are varied, but no other one cause received enough votes to be regarded as significant. Among other causes given were the following: "Severe tonsillitis," 1; "colds," 5; "scarlet fever," 1; "flu," 1; and chronic bronchitis, 1. "Hasty eating and improper mastication" were given as causes by 5. Odd causes mentioned by some patients were as follows: "Severe electric shock," 1; "poison drink," 1; "drinking very cold water on a warm day," 2; "taking endocrine tablets for reducing," 1; "driving an automobile," 1; and "pressure from a bit-brace used in a wood-working shop," 1. Twenty-one of the patients stated that they "had no idea" as to the cause.

Treatment

Most American authorities believe that the safest and best treatment is over-stretching of the functional stenosis by air or water pressure, though good results are also reported, especially by the German writers, from the use of various other types of mechanical dilators, as well as from operations such as cardiomyotomy and esophago-gastrostomy. The only methods with which I am familiar are hydrostatic and pneumatic dilatation. The

latter is more convenient, and in our experience, just as effective as the former. Obviously, any sort of dilator must be accurately placed to accomplish results, and this end is admirably accomplished by means of the barium-striped pneumatic dilator of Mosher. At least the first dilatation is done under the fluoroscope, so that an accurate measurement can be taken from the point of constriction to the upper teeth. To facilitate the taking of this measurement we have our dilator calibrated in centimeters from the middle of the bag upward. When the apparatus is in such a position that, on inflation, the constriction of the bag is seen to be exactly in its middle, we read the measurement at the patient's upper teeth. This measurement is recorded for use in subsequent placements of the dilator, which need not necessarily be under fluoroscopic guidance. The average measurement in our cases has been 40 cm.; the shortest 33 cm., and the longest 50 cm. Accuracy of placement is, of course, not the only advantage of fluoroscopic dilatation; it is often of interest to note the relation of the stenosis to the level of the diaphragm, the shape of the stenosis, and its extent, as well as the width to which it may be stretched at certain pressures.

Dramatic improvement generally follows the first treatment, provided the dilator has been accurately placed. Despite very marked improvement after the first dilatation, however, it is generally advisable to give a series of dilatations at intervals of a few days, spacing out subsequent ones according to indications. We prefer to give a series of stretchings, gradually increasing the pressure used, rather than using a maximum pressure at the first sitting. Sufficient pressure is used to give the patient a very definite sensation, but not sufficient to cause severe pain. Better results seem to be obtained if the dilator is allowed to remain in place from one to five minutes after inflation.

Of the fifty patients replying to our questionnaire, only four have failed to note marked improvement from dilatation, though a number still have occasional symptoms and are still under treatment.

Though instrumental dilatation of the "lower pinchcock" is the most important item in treatment, a number of other therapeutic considerations are worthy of attention. Most of these may be grouped under the head of proper medical care and management, which

means rest, avoidance of excitement and fatigue, proper regulation of the bowels, and, in patients with marked dilatation of the esophagus, nightly esophageal lavage.

Diet is extremely important, and the replies to our questionnaire confirm our previous views on the subject, namely, that a "smooth" diet is best, with the exclusion of all fibrous vegetables and fruits, and all rough or stringy meats, as well as coffee, alcoholic beverages and condiments. The questionnaire emphasized for us the importance of a point mentioned by others, namely, the effect of the temperature of food and drink. Hot foods were emphatically favored by 31 out of 50 patients in replying to the question, "Do hot or cold foods go down better?" One said, "Hot foods go *much* better;" another, "Hot foods, positively!"; and another went into great detail concerning her habit of taking a drink of hot water before meals "to open her throat." Ice cream was mentioned by a number as particularly troublesome, while custard was a favorite among foods giving least trouble. Hot soups, hot cereals, hot stewed fruits and vegetables were also among the things found most satisfactory.

Conclusions

Before concluding, I wish to state that I have intentionally avoided discussing the pathogenesis or pathology of so-called "cardiospasm." Though a very large amount of work has been done on this phase of the subject, there remain many points to be clarified and space does not permit me to discuss the various theories. This paper may be criticized as being too empirical, attaching too much importance to what the patient tells the doctor, but it was planned with that intention. I started out to make a purely clinical study, with an open mind. I wished to know what *the patient* thought brought on his trouble, and what he thought made it worse; what the patient's experience with various diets had been, what foods had seemed to cause most trouble, what foods to cause least, and specifically, whether hot or cold foods seemed to go down the better. Lastly, I wished to know, in the patient's own written words, whether or not dilatations had been beneficial, and I asked them to answer this last question fully telling just how their present condition compared with their condition previous to the treatments.

Sometimes we make too little effort to get the patient's point of view, and yet it is important to do so in studying or treating any condition. I feel that the questionnaire on which a large part of this paper was based has been of definite value to me, though I fully recognize the limitations of the method.

In conclusion, the following postulates are offered for your consideration:

(1) *Esophagoscopy* is always indicated to confirm the diagnosis in esophageal disease.

(2) *Psychoneurotic* factors are probably of considerable importance as exciting and perpetuating causes in most cases of so-called "cardiospasm."

(3) *Pneumatic dilatation*, with accurate fluoroscopic placement of the dilator at the first sitting, is a convenient, safe, and efficient method of treatment in this condition.

(4) *Diet* is important in the management of these cases and it should be of a "smooth" character, but should not include ice cream, ices, or cold drinks.

3432 N. Broad Street.

Discussion

Francis L. Lederer, (Chicago): The illustrious father of the essayist stated a number of years ago that he felt that the time would come when every patient with the slightest discomfort or abnormality in swallowing, every patient with pain or discomfort back of the sternum, every patient with gastric hematemesis, regurgitation and "heart" burn will be examined esophagoscopically. Although this thought was expressed regarding peptic ulcers of the esophagus, the same is true in the consideration of many of the lesions and dysfunctions of the esophagus, the method having gained considerable impetus through the efforts of pioneers, such as Jackson, Senior in this field. Recognition of pathology, its treatment, and now a better understanding of the physiology is made possible. Ramifications of a method originally intended for the extraction of foreign bodies today have become so numerous that the original purpose constitutes but a small percentage of its use.

Dr. Jackson objects to terms that do not accurately describe a condition anatomically. He wishes to discard cardiospasm in favor of preventriculosis because actually the former infers that the obstruction is spasmodic and at the cardia. He, therefore, suitably speaks of a location in front of the stomach, without implying an etiology. He believes that such an entity is due to a failure in the coördinate opening of the cricopharyngeal pinchcock in the process of deglutition, and in functional cases the diaphragmatic pinchcock fails to open at the approach of food.

Similar to many other conditions this entity suffers from a variety of synonyms. In addition

to cardiospasm and preventriculosis, achalasia (inability to relax), phrenospasm, ingluveosis, spasm of the cardia (transient), hiatal esophagismus and stenosis have been applied. Jackson has considered it as a degenerative change in the plexus of Auerbach-Meissner but cannot account for the changes. Rolleston, 35 years ago, considered it a neuromuscular incoordination. Mosher has felt that it is due to visceral organ change, especially the liver, where oftentimes he was able to demonstrate organic changes. Changes in the left lower lobe of the lung and kinking of the abdominal esophagus have also been demonstrated. As with other entities, cardiospasm is in for its share of etiological factors based on endocrine imbalances and neuroses.

Since the plexus serves to control too great an activity on the part of the muscle, it is quite likely that a disease of these fibres could remove such an inhibitory power, thus resulting in an overactivity. Proof of this is not entirely forthcoming because function of these plexuses is merely a matter of conjecture. Nevertheless the most authoritative opinions would definitely consider the condition not a spasm but we would class it as an autonomic nervous system dysfunction, embodying both vagus parasympathetic and calliac sympathetic.

Symptomatically, it is quite apparent that the cardinal complaints referable to stomach distress are too vague to be definitely pathognomonic or diagnostic. The x-ray investigation and the direct examination by esophagoscopy are, therefore, the determining evaluators. That appearance of the mucosa, so characteristic that it may be diagnostic, resembles somewhat the change known as pachydermia, the mucosa being so thick that it is rugated.

It is often surprising how a condition that may be of such long standing and manifesting such definite changes may so definitely, and by comparatively so simple a means, be permanently relieved. It is perhaps the simplicity of this therapy that has led to the mishaps. The distressing incidents which have followed dilatation of the hiatus, have been due to improper diagnosis.

Case Report

Name: G. M. Female. Age 6.

Present Complaint: Difficulty in swallowing.

History: Child was first brought to the Research and Educational Hospital November 19, 1929, with this complaint of two months duration. Mother states that the trouble began two weeks following scarlet fever, when child began to hiccup and regurgitate her food immediately. This became so marked that she could only take fluids and soft foods. If she attempted to eat solid food it would stick in her esophagus, and child would complain of intrascapular pain. Child has lost five pounds in two months. For a period of two months she was observed on the pediatric service, and based upon the negative esophagoscopy findings of a well-known endoscopist, the first work-up of the case was directed along the lines of a functional or

neurogenic etiology. This mode of attack having failed, the patient was given x-ray therapy on the basis of a purely hypothetical assumption of enlarged mediastinal glands. This seemed to give temporary relief, but difficulty again returned. The child acted retiring and shy, and impressed the physicians as secretive, that being aware of a deception, she was attempting to maintain her position. Neurologists and child psychologists saw her and were impressed with this attitude and especially since it was felt that mechanical or organic causes were ruled out. She was allowed to go home for a time and asked to return for us to examine esophagoscopically on February 4, 1930, as she was still regurgitating her food.

Examination: From the foregoing, it can be assumed that this child had every imaginable form of examination and all seemed to throw no particular light on the etiology. The x-ray findings were at a variance, for on the first admittance (November 19, 1929) they reported a probable slight obstruction at about the junction of the middle and lower third. The lumen has smooth outlines. The roentgen diagnosis was a probable spasm of the esophagus with temporary delay of progress of the opaque meal. Then even after our examination (February 2, 1930) they report no pathology found in the films observed.

On February 4, 1930, without anesthesia, we passed the esophagoscope. There was a slight spasm at the first narrowing, but that subsided and we were able to proceed to the junction of the middle and the lower third, where we found an organic stricture, web-like in character, stretched across the esophagus, with an opening in the center about one-third of an inch in diameter. As was said before, the x-ray did not confirm our findings, but the fluoroscopic observation showed a very definite stoppage of the barium at the level indicated by esophagoscopy.

Treatment: We advised an attempt to gradually dilate this stricture, or, if that did not suffice, to cut this web-like constriction and then slowly dilate. The mother stated she wished to go to Philadelphia where a brother, who was a physician, could be present when the work was being done. We were happy to learn that she was to be in good hands. We subsequently learned that she returned to the endoscopist, who originally examined the child in our city. He again examined her and confirmed his first diagnosis of spasm. He tried to forcibly dilate the esophagus, and in doing so evidently made false passage, for the child succumbed and post-mortem findings revealed a mediastinal abscess and confirmed the diagnosis of organic stricture.

Comment: This history in its original form is worthy of careful study to see what a negative endoscopic examination could do to a group of clinicians. An irresponsible child of six, shy and for good reason regurgitating food, was tagged with a psychoneurotic label. The unfortunate course, due to an improper interpretation of a pathological picture, is indeed a sad commentary, and allows but little to be said. According to concepts of this entity the very fact that the cricopharyngeal constrict-

tor was active should have indicated a diagnosis other than preventriculosis.

In closing I would suggest an experimental attack on this condition, not only from the functional origin which is concerned with the dysfunction of efferent (motor) autonomic stimuli,

but also afferent, organic disease of these plexuses which are so important in initiating these coordinated reflex conditions. We are, in our clinic, now engaged in a study of peripheral motor dysfunctions from the angle of peripheral motor and sensory nerves.

Germ's Conquests Aided by Strange Spreading Factor

Germ's invading living tissue succeed in adding new territory to their conquests if they can bring about the production of a "spreading factor," and fail if this factor is not produced. Highly virulent germ's fail to spread if they are not thus aided, while relatively mild-mannered disease organisms will take in a lot of territory and raise much trouble if they have the backing of the "spreading factor." The virulence, or inherent poisonousness, of a germ has no necessary connection with its ability to spread its infection.

These are among the new facts about infection and its spread that have been discovered lately at the Rockefeller Institute in New York City. What this "spreading factor" is that makes it easier for germ's to invade new territory in the tissues, nobody knows as yet, though a clue to its possible chemical nature has already been turned up. But something of the way it acts has been worked out, notably by Dr. F. Duran-Reynals.

The "spreading factor" was first found in extracts of animal tissues, notably the male sex glands. Such tissue extracts, injected into the bodies of rabbits along with small quantities of bacteria, enabled the latter to spread rapidly, while inoculations with the same bacteria without the backing of the "spreading factor" extracts spread much more slowly or not at all.

Then Dr. Duran-Reynals succeeded in making extracts of germ's that were able to spread rapidly without such help, and found that these extracts also were rich in the "spreading factor." They aided germ's that were backward about spreading to penetrate the tissues, and even brought about the spread of infections elsewhere on the body. Furthermore,

these "spreading factor" extracts obtained from germ cultures aided the spread of other germ species: They were non-specific in their action. They also aided the spread of vaccine virus, which is made of what might be called harmless germ's.

One practical significance of this "spreading factor" is pointed out by Dr. Duran-Reynals. It is possible that a germ relatively harmless in itself but richly endowed with the factor might make possible the rapid spread of another germ of much more dangerous nature which would otherwise be unable to gain a foothold due to its lack of the factor.

Whatever the "spreading factor" is, it does not seem to be closely related to those noxious agents which induce the formation of the antitoxins and other "antibodies" that help to protect us from disease. It differs from them in three ways: it does not cause the generation of "anti-bodies" that act against it, it is non-specific, and it can be heated without being destroyed.

Dr. Albert Claude, also of the Rockefeller Institute, has made the initial steps toward a chemical understanding of what this "spreading factor" is. He has found that substances containing it combine with diazo-compounds, thus giving what is known to chemists as the "diazo reaction." Diazo compounds are a special chemical group characterized, among other things, by the presence of two nitrogen atoms as critical units in their structure.

Furthermore, Dr. Claude found that various synthetic compounds having the diazo group in common would give quite similar results and also possessed the peculiar property of increasing tissue permeability and enhancing infection. These observations brought together, it appears possible that the "spreading factor," if not itself a diazo compound, might be similar to the members of that chemical group. — *Science News Letter*, November 4, 1933.

ATTEND SPRING SESSION

EASTERN SECTION

AMERICAN CONGRESS OF PHYSICAL THERAPY

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SEE

COMPLETE PROGRAM, PAGE 192

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E D I T O R I A L S

D'ARSONVAL AND HYPERPYREXIA

The empiricism of heat therapy by various appliances but needed the brilliant direction of d'Arsonval's discoveries in the field of high frequency radiation to remove that protean method from the ranks of household and bathhouse remedies, and to establish it as an agency of scientific importance in medical practice. Thus within the last four decades heat therapy has received an impulse leading to gradual replacement of the speculative theories of past generations by scientific facts, now accepted as a basic action of operative thermodynamics in relation to radiation phenomena.

At the risk of restating historic facts it is recalled that d'Arsonval's earliest contributions dealt with the ability of raising body temperature and influencing toxic and metabolic processes. Stimulated by, or perhaps independent of, Hertz, the experimental data of d'Arsonval included studies of electrical oscillations ranging from those provoking neuromuscular contractions to frequencies up to 100 million cycles per second. Accordingly the impulse to the present state of our knowledge originated with his discovery of the ability to heat living tissues without any untoward effect. That this

in turn led to the perfection of apparatus which has removed the "*chaleur désagréable*" — the disagreeable heat sensation — due to faradic effects, or to instruments operated by tubes and by frequencies higher and more sustained, in no way detracts from the initial light shed by d'Arsonval. His discovery was so basic in nature that he must even be regarded as the first to have demonstrated the general or systemic pyretic quality of high frequency current by means of the solenoid. Auto-conduction or d'Arsonvalization, a method in disuse because of the spectacular appeal of succeeding innovations, promises to return, perhaps under a new name, but it will still be the induced high frequency current discussed and used in authoritative circles.

No matter what view one may hold regarding the merits of hyperpyrexia, the entire problem is reducible to the simple and basic facts established with diathermy. This consists of the introduction and absorption of energy of certain frequencies and its conversion into caloric unit. Whether sustained pyrexia is controlled by means of insolation by blankets plus diathermy, insolation plus short wave radiation, or by means of insola-

tion plus visible or invisible infrared radiation, the effects are practically of the same dramatic quality.

The evaluation of any new concept fundamental in nature is a process in which experiences are integrated in so orderly a fashion as to provide reasonable explanations for relations even most cryptic. The discovery of controllable pyretotherapy for such unrelated conditions as general paresis, multiple sclerosis, gonorrheal and selected cases of chronic infective arthritis was a splendid achievement. That it followed the work of Schereschewsky and Esau, who paved the way for a new orientation with reference to fever therapy, in no way detracts from the original value of the contribution nor the special recognition of individuals associated in this labor. Indeed, each contribution has been an added integration in the experience of high frequency therapy, emphasizing its potential possibilities, the vast terrain as yet unexplored, and the direction it is now taking. According to Neymann and Osborne,⁽¹⁾ encouraging results have been obtained in such diversified affections as tabes, cerebrospinal lues, and optic atrophy. It is interesting to note that in the series of optic atrophy treated by these men 66 per cent of the patients retained or showed improvement in their vision. Of 544 cases of dementia paralytica treated by these as well as other investigators, 30 per cent developed complete, and 29 per cent partial remissions, and 3 per cent died as a result of treatment. This therapy, therefore, although still in its infancy, has by the very work cited above justified its position as a new advent in modern thermotherapy.

For details attention is directed to the symposium elsewhere in this issue, not only because it is the most representative exposition on the subject by American investigators, but because it is the most composite review of a therapeutic procedure that has opened a new approach to the control, if not the complete elimination of certain affections beyond the scope of medicinal therapy. Success here as in other medical endeavors depends upon the intelligence behind the treatment. Perhaps the soundest evaluation offered is that by Bierman who stated: "Whether there will be an

agreement of this measure in the treatment of various diseases or not, all workers are definitely agreed that in certain conditions this measure appears to closely approach the ideal." To the pessimism of Bergonié who remarked that "high frequency has come too soon to a physiotherapy too young," d'Arsonval⁽²⁾ has presented his contribution for the verdict of the scientific world by remarking: "If this new road opened to therapy is full of promise, I must inform the physicians that all is to be accomplished from the clinical standpoint. I have shown that high frequency is a powerful modifier of the organism. There, for the moment, is limited my rôle as a physiologist."

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BREAST TUMORS AND ELECTRO-SURGERY

Tumors of the breast, especially of the female mammary gland, represent one of the most difficult problems of modern surgery. Absence of symptoms in the beginning of a carcinomatous growth of the breast and the failure to insure regular, periodic health examinations of our entire population have resulted in countless women going about apparently in the best of health, detecting "lumps" in their breasts quite accidentally. On then consulting a physician, determination of the length of the existence of the tumor — if a tumor it actually be — is impossible. This circumstance clearly shows that if the philanthropists who devote funds for the socialization of the practice of medicine would use their money to insure for certain groups of women periodic examinations, they would accomplish something worth while and of immediate benefit.

In the absence of such a widespread movement the patients are indeed lucky if they consult a careful and conscientious practitioner before the diagnosis of malignancy of the

breast is self-evident, that is at a time when the differentiation between a benign and a malignant growth is still a matter of doubt. This doubt is readily understandable when one considers the similarity of phenomena of all types of tumors of the breast. Here, then, the aid of a competent pathologist must be obtained. Moral responsibility for the correctness of diagnosis must be shared by both clinician and pathologist, for often enough the microscopic picture of even suspected lesions will be puzzling to expert histologists.

In this respect we cannot strongly enough condemn the recent teachings that "in doubtful cases the microscopic examinations of a *small piece*, removed for biopsy, has the deciding vote." Such a teaching is dangerous, because the excision of a small part of a given growth, if it really should be a malignant one, is almost sure to result in metastases. Even before the advent of the high frequency current the authorities should have stressed the vital importance of completely extirpating every suspected tumor both for biopsy and as a matter of safety. It has happened repeatedly that parts of excised tumors, obtained through a comparatively small exploratory incision, have been reported back as "benign" when the surgeon has not reached deep enough to remove a malignant part.

In certain quarters the idea has gained ground that the high frequency cutting current has rendered the excision of a small piece of suspected tissue a safe procedure. That is not a correct concept. The cutting current is essentially a weak coagulating current and because of the fact there is no assurance that it will effectively seal all blood and lymph vessels. Accordingly the element of safety promised by electrosurgery should not be brought into disrepute through the failure to observe the rule, *never to remove any suspected growth except by complete extirpation through an apparently normal zone*. Even then one cannot absolutely rely on ocular inspection and should take every known precautionary measure.

From the standpoint of therapy, the value of electrosurgery for malignancies is no longer debatable. It is not only, as has been repeatedly pointed out in the *ARCHIVES*, the method of choice, but failure to employ it constitutes a gross technical error. This being so, the utilization of the high frequency cut-

ting current for the removal of the entire malignant breast, should become general throughout the world.

Whether or not electrosurgery has made it possible to reduce the extent of amputations of the breast, is not yet definitely settled. There are available at this time too few observations for definite conclusions, so that no hard and fast rule can be laid down. While it is true that some surgeons in the past five or six years have contented themselves with less radical measures than those advocated for classic extirpations of the breast, and have not seen any metastases, these observations must be interpreted with great caution, for we have also quite a number of reports of local recurrences. It is, however, encouraging to report that the simple removal of these local recurrences by either electrotomy or electrocoagulation, either of which have been undertaken as office procedures under local analgesia, has proven adequate in cases that have remained under observation for several years. There can be no doubt that electrosurgery is the safest and most effective method of dealing with malignant tumors of the breast, to say nothing of its surprisingly good palliative effect in advanced cases heretofore regarded as hopeless.

THE INDIANAPOLIS MEETING

Regional meetings of the American Congress of Physical Therapy have in the past been regarded as purely local events of little general interest. The limited program and the restricted attendance certainly could not compete with the magnitude of our annual national conventions. It will, therefore, be a matter of pleasant surprise to all who did not attend the meeting of the midwest section, held in Indianapolis on March 13, to learn that with the exception of its limited duration, it bid fair to rival our national conventions, quantitatively as well as qualitatively. Never before in the history of our Congress has a regional meeting assumed such states-wide importance as the inspiring one-day convention in the beautiful capital of the Hoosier state.

Under the tactful chairmanship of Dr. Edwin N. Kime, members of the Congress and visitors were at the very outset made

to feel that it was not only their meeting but that one and all were heartily welcome. This engendered a spirit of cordiality through the clinics and scientific sessions which stimulated the essayists and their discussions to offer the best with unusual "éclat."

The forenoon was devoted to witnessing electrosurgery by Kime at the University Hospital, where a number of operations were performed with skill. Those who appeared to know little of electrosurgery were encouraged to ask questions, and these gave rise to specific demonstrations rendered in informal fashion.

The Indiana University Medical School hospitably placed at the disposal of the convention its large auditorium, fully equipped with the most modern appliances for good acoustics and for illustrated lectures. The meeting was called to order by the Chairman promptly at one in the afternoon. The large amphitheater and the balcony were filled by members, visiting physicians, medical students, and nurses, all apparently assembled in a spirit of thirst for knowledge. It is difficult to convey an adequate idea of the enthusiasm displayed by the audience at the conclusion of each address and discussion. Nor was there any lack of appreciation of the wit and good natured raillery which punctuated one or the other discussants' remarks of a personal nature. Every one of the papers announced in the February issue of the ARCHIVES was read in the order of the program, the last two in the meeting place of the Indianapolis Medical Society and in conjunction with that organization.

Among the incidents not previously announced was the address of welcome by Willis Dew Gatch, Dean of the University

Medical School, in which he clearly showed his interest in and appreciation of modern Physical Medicine and Surgery. The meeting thus having received official recognition, as it were, other medical dignitaries, among them the President of the Indiana State Medical Society, followed suit. Then followed the announced program. Kime's address included an array of patients who had undergone major electrosurgical operations for malignancies, the favorable end results of which impressed every one with the efficacy of electrosurgery. An outstanding paper dealt with the Physico-Chemical Basis of Physical Therapy, an address as profound as it was interesting. But all other papers did not lack in instructional value, for they dealt with the clinical problems of every day practice. It was altogether a day spent profitably and joyously.

Considering that our Chairman had succeeded in providing not only a vast amount of clinical material but had secured the hearty cooperation of a great medical school, considering further that he succeeded in bringing to the day's conferences several hundred non-members and a large number of senior medical students, the meeting must be regarded as a fine piece of educational propaganda for Physical Medicine and Surgery, entirely apart from the intrinsic merit of the scientific program. His efforts are certain to result in new recruits for our none too large army of physicians who avail themselves of the beneficial effects of physical therapeutic agents in general medicine, surgery, and their subdivisions. We express our appreciation to Kime, and at the same time our hope and wish that other regional meetings may in future duplicate the success of the one held this spring in Indianapolis.

CURRENT NEWS AND SCIENCE

Dr. Titus Returns from Abroad

It will be of great interest to the many friends and acquaintances of Dr. Titus to know that his short holiday trip to London and Paris included besides rest and recreation, the responsible task of acting as special envoy of the Congress in connection with decorating our distinguished colleagues abroad—Turrell of Oxford, England, and Regaud of Paris, France. We are informed by official authority that both of the recipients of the 1933 Gold Medal award for meritorious service in the field of physical medicine received their gift under impressive circumstances. For this special work the Congress acknowledges its appreciation.

Dr. Riviere Honored by France

It is a pleasure to announce that the Republic of France has honored one of our members and a citizen of France for his special labors in the field of physical therapy. We congratulate Dr. Joseph Riviere for receiving the special distinction of Commandeur de la Legion d'Honneur.

Pacific Physical Therapy Association

The regular monthly meeting of the Pacific Physical Therapy Association will be held at the Hollywood Hospital, March 28, and the following papers will be presented:

1. "Some Physiological Aspects of Hydrotherapy," Fred B. Moor, M. D.
2. "Infection of the Hand and Its Treatment." Anatomical Demonstration with Specimens. L. C. Kellogg, M.D.

Meeting of the "Floating Congress"

Among the many distinguished guests who will address the Pan-American Medical Association will be our Kovács who will present several papers on physical therapy topics. Our energetic confrere is also preparing to participate as a guest and teacher in the forthcoming post-graduate tour to Budapest which will be announced in greater detail in a future issue of the ARCHIVES.

Physical Therapy Section Medical Society of the State of New York

Dr. Richard Kovacs, Chairman of the Section of Physical Therapy of the New York State Medical Society submits the following program, to be held in Utica, N. Y., May 16, 1934 at 9:00 A. M.:

1. The Physical Therapy Department in a Hospital. Frederick E. Bauer, M.D., New York. Dis-

cussors: Lee A. Hadley, M.D., Syracuse; K. G. Hansson, M.D., New York.

2. Physical Therapy in General Practice. Harold J. Harris, M.D., Westport. Discussors: Madge C. L. McGuinness, M.D., New York; G. H. Turrell, M.D., Smithtown Branch, N. Y.

3. Physical Therapy in Industrial Injuries. John B. Stevens, M.D., Syracuse. Discussors: H. J. Knickerbocker, M.D., Geneva; James W. Wiltsie, M.D., Binghamton.

4. The Work of the Council on Physical Therapy of the American Medical Ass'n. John S. Coulter, M.D., Chicago (by invitation). Discussors: Thos. P. Farmer, M.D., Syracuse; Richard Kovács, M.D., New York.

5. Physical Therapy in a Health Resort. Walter S. McClellan, M.D., Saratoga Springs, N. Y. Discussors: G. S. Towne, M.D., Saratoga Springs; John deP. Currence, M.D., New York.

Anti-Growth Factor Found in Parathyroid Glands

Definite evidence of an anti-growth factor in the parathyroid gland has recently been found by Drs. C. J. Eastland, N. Evers and J. H. Thompson, working at Kings College, London, and the Royal College of Surgeons, England.

These investigators treated fresh parathyroid gland in a special way and obtained an extract which had a harmful effect on the growth of rats, they reported to the *Biochemical Journal*. Six rats were used as controls, and six were given daily injections of a small measured amount of the extract, other conditions being the same for both groups of rats.

The factor which retarded the growth was destroyed by treatment with hydrogen peroxide.

Hormone Treatment Halts Premature Aging of Women

Slightly reminiscent of the Steinach rejuvenation operation and the fiction of Gertrude Atherton's much discussed novel, *Black Oxen*, is a treatment for premature aging in women which two St. Louis physicians are now studying. The treatment makes use of one of the very modern medical agents, a hormone called theelin.

Symptoms of premature old age in five women, following surgical removal of certain organs which had become diseased, were relieved by treatment with theelin, Drs. August A. Werner and W. D. Collier reported to the American Medical Association. In most respects the patients had the feelings and bodily functions of normal women.

These cases seem to bear out the theories regarding the function and possible clinical use of theelin held by the original discoverers and investigators of this potent hormone.

Tannic Acid Bath Features Modern Treatment of Burns

A three-hour bath in tannic acid during which the burns become well tanned is a feature of the modern treatment of extensive burns as described by Dr. Donald B. Wells of Hartford, Conn., at a meeting of the American Medical Association.

The use of tannic acid relieves the pain sufficiently so that the burned areas can be thoroughly cleaned. In this way infection can be prevented. Infection alone was the cause of the exhausting illness, many of the complications and a majority of the deaths from burns in the old days, in Dr. Wells' opinion.

The person with extensive burns is placed in a large tub of tannic acid solution, according to Dr. Wells' plan of treatment.

"He receives quantities of liquids to drink, in order to balance the loss of water. As soon as his pain is somewhat relieved, several attendants begin to work. For three hours they remove burned tissue as the solution loosens it and clean unburned areas with soap and water.

"By the time the patient is ready to be placed in bed a tan has formed over the burned portions. Then for seventy-two hours warm air is blown on him from an ordinary hair drier, while he is more or less constantly sprayed with tannic acid solution. After this the blower is used alone until the tissue has become perfectly firm, for only a little perspiration may break it and invite invasion by germs," Dr. Wells explained.

The method is especially successful in burns from gasoline explosions, ignited clothing and extensive scalds, he said. It can be used in any good hospital.

Do Not Try to Visualize Atomic Heart, Is Advice

The nucleus of the atom has been described at various times as analogous to a solid or crystal, or to a liquid or droplet, or as a complicated molecule. Recently a further analogy has depicted the nucleus as a system resembling an atom which, instead of having electrons moving about a center, had protons and neutrons whirling about.

All of these models have had successes which were discussed by Dr. R. M. Langer of the California Institute of Technology in a recent symposium. Dr. Langer emphasized the fact that there must be some general principles underlying the various successes of these points of view, and that no success of this type could be taken as an indication that the model which it used was the correct one.

In fact, Prof. Niels Bohr, the Danish physicist

now at Pasadena, feels that for the time being we should try to get along as much as possible without a model of the nucleus. Some features cannot be described in terms of notions with which we are familiar. The nucleus has masses and charges in it, says Prof. Bohr. We know something about the total values of these components and we had better admit ignorance about the details of structure.

Dr. Langer showed how he and R. W. Raitt were led to expect that beryllium alone of all the known light weight elements is unstable. This expectation was verified experimentally. Further investigations are planned with volatile organic compounds containing beryllium. If such compounds can be prepared the whole subject could be clarified in a short time.

Vitamin D Prepared in Concentrated Form

Vitamin D, in the form of an extract of cod liver oil so potent that ten drops are of equal vitamin D value with three teaspoonfuls of standard cod liver oil, is now available to the medical profession. This natural vitamin D is not an irradiated product and not a cod liver oil concentrate, but an extract of the rickets-preventing principle of the oil. It is stated to be free from objectional taste.

The new product was developed by Prof. Theodore F. Zucker of the College of Physicians and Surgeons at Columbia University, and the privilege of distributing it through regular medical channels has been licensed to the S. M. A. Corporation in Cleveland. This firm is already distributing the recently isolated primary vitamin A, and expects soon to have a combination of A and D to offer for medical use.

Pictures on Paper Reduce Cost of X-Raying

The cost of detecting tuberculosis in high school pupils was cut in half by the use of paper x-ray pictures, Dr. H. R. Edwards of New Haven, Conn., told the National Tuberculosis Association.

The paper x-ray photographs replaced celluloid films for tuberculin tests. They were said to be equal in quality to the celluloid x-ray films and they could be handled much faster and with less eye strain on the physician examining them.

The total cost of detecting 960 cases out of 6,393 examinations and referring them to the family doctors, including the cost of the paper x-rays which were paid for by the parents, was \$6,255. The actual cost per case was \$6.51.

THE STUDENT'S LIBRARY

FOOD NUTRITION AND HEALTH. By *E. V. McCollum*, Ph.D., Sc.D., and *J. Ernestine Becker*, M.A., Professor, and Associate, of Biochemistry, School of Hygiene and Public Health, Johns Hopkins University, Baltimore, Maryland. Third Edition. Cloth. Pp. 146. Price \$1.50. Baltimore: The Lord Baltimore Press, 1933.

It is unusual that a book in its third edition has reached its eleventh reprint, but this is not difficult to appreciate because of the widespread appeal and need for the material presented. As the authors state, they have endeavored to "set forth in simple language the nature of an adequate diet as the biochemist visualizes it . . . and to recommend a system of diet which will promote health, and which is sound from the agricultural, physiological and economic standpoint. It is hoped that this information will enable the readers to detect the misinformation now being so widely disseminated by fad-dists. . . ."

McCollum has long pioneered in the science of nutrition and has raised the standards of this discipline to its present level of high recognition in the medical field. Just as it is difficult to understand what is abnormal until we have a sound idea of the normal, so does the reading of this small volume enable one to have a clear picture of what constitutes an adequate diet because of the recognition of the violation of certain fundamental principles.

The contents are divided into 22 chapters, to which are added menu suggestions, a table which contains the distribution of vitamins in foodstuffs, and an index. These chapters cover in addition to what is found in most textbooks on nutrition information devoted to each of the vitamins, a subject with which McCollum's name has long been associated. While space will not permit listing each chapter, several of these deserve mention because of their timeliness in nutrition such as discussions of the nutritive value of tea and coffee, nutrition of the nervous system, reducing diet, increase of weight, prophylactic dentistry, pregnancy, etc.

The authors give three rules as a guide in planning the diet. First, everyone daily throughout life should take the equivalent of one quart of milk. As a nation we take about half of this amount. Second, once each day take a liberal serving of greens and pot-herbs, which should be cooked, in order to correct the tendency to constipation brought on by refined foods. Third, twice each day a salad should be eaten. The authors go quite into detail to define and set forth just what constitutes a salad, encouraging thereby the intake of raw foods. They have adopted a slogan, "Eat what you want after you have eaten what you should."

This book is so informative as to enable the practitioner to more easily obtain the patient's point of

view and to greatly facilitate his dietary problems, as well as to provide him with an up-to-date knowledge of the progress in nutrition.

THE PRACTICAL MEDICINE YEAR BOOKS OF 1933: GENERAL MEDICINE, INFECTIOUS DISEASES, Edited by *George F. Dick*, M.D., Chicago; DISEASES OF CHEST, Edited by *Lawrasan Brown*, M.D., New York; DISEASES OF THE BLOOD AND BLOOD-FORMING ORGANS, Edited by *George R. Minot*, M.D., and *William B. Castle*, M.D., Boston; DISEASES OF HEART AND BLOOD VESSELS, Edited by *William D. Stroud*, M.D., Philadelphia; DISEASES OF THE DIGESTIVE SYSTEM AND OF METABOLISM, Edited by *George B. Eusterman*, M.D., Rochester, Minn. Cloth. Pp. 831. Price \$3.00. Chicago: The Year Book, Publishers, 1933.

The 1933 year book of General Medicine is representative of the high standard set for this publication and is a splendid example of what critical and intelligent abstracting can do in the survey of a field as important as this volume has incorporated. The introductory remarks by the editors in several of their respective sections is a work that should be encouraged and enlarged, for no one is in better position to point out the trend, tendencies and fallacies better than the one who already possesses a bird's-eye view of the recent contributions in his respective branch of medicine. We believe this to be a practical innovation that will redound to the benefit of the series in general. The editorial comments appended at the end of some of the abstracts in smaller type is a practical improvement in the format and worth retaining in future numbers. The increasing size of each year book speaks well for the greater service it offers, a service which no progressive physician can well afford to be without. The book has a general and authors' index.

LIFE-GIVING LIGHT. By *Charles Sheard*, Ph.D., Sc.D., Professor and Director of Biophysical Research, The Mayo Foundation, University of Minnesota, and the Mayo Clinic. Cloth. Pp. 174 with illustrations. Price \$1.00. Baltimore: The Williams & Wilkins Company, in cooperation with the Century of Progress Exposition, 1933.

This is a splendid contribution to the understanding of Light in relation to Life. In the space of 174 pages the author, an eminent biophysicist, presents the story of Life-giving Light in such a clear, colorful and yet informal fashion as to enable him to introduce a mass of important information in a literary style so delightful that it holds the reader's increasing interest until the last page has been reached. Within the space of eight chapters the significance and the importance of Light is woven into fascinating discussions, these being loaded with

such rare facts as to challenge the writings of our best fictionists. Moreover, the subject matter of each chapter is rounded out in a style so exceptional as to suggest the leisure and brilliant essay of the educated scholar. The author has the faculty of summarizing important thoughts and experiences into aphorismic sentences that clarify the most technical topics related to his thesis. A vivid picture is projected that Light is the important link in time and space dimensions as conceived by modern science, that Light is the all important link between the organic and inorganic worlds, that Light holds the very mystery and secret of Life. Separate chapters are devoted to the comparison of man-made light to that of the sun and the chemiluminescence of eternal light; to the thought provoking picture of man as a radio receiving station; to the story of what is beyond the red and the blue of the spectrum; the measuring and weighing of energy; the story of optics; making the invisible visible; to the nature of artificial and natural sunshine, with its vitamin producing substances; and to the Mystery of Mysteries—Life. This is an extraordinary book—a veritable treasure house of information. It is recommended with the highest enthusiasm because it is one of the most profitable investments a progressive individual can make.

DEFORMITÄTEN UND KOSMETISCHE OPERATIONEN DER WEIBLICHEN BRUST (Deformities and Cosmetic Operations of the Female Mamma). By *Dr. Hermann Biesenberger*, Senior Surgeon at the Red Cross Hospital "Rudolfshaus" in Vienna. Cloth. Price, 18 marks. Pp. 209. Vienna: Wilhelm Maudrich (American Agency: Chicago Medical Book Co., Chicago), 1931.

To all surgeons who care to undertake corrective operations for the relief of women suffering from deformed, hypertrophic, pendulous or asymmetric mammary glands this monograph is indispensable. Nor should lack of knowledge of the German language be a deterrent, because the author has so clearly illustrated the various operations that have been used by a number of surgeons of continental Europe, one may say step by step, that the technic can be learned without the text. Biesenberger is known in the surgical world as the author of an operation which has proven very successful in the hands of many operators, including the reviewer, for plastic correction and reduction of pathologically large breasts. In spite of the superiority of his method, which has been thought out with care and appears best capable of producing anatomic and cosmetic restitution to normal, the author has impartially presented virtually all known methods, all of which have been evolved under the inspiration of the first cosmetic corrective scheme evolved by Lexer-Kraske. The book proper contains a highly interesting study of the anatomy and deformities of the mammary glands, of the reasons why reparative surgery is justifiable, and a general historic survey of the entire problem. The monograph is really complete, except that the bibliography at the end of the volume fails to give the entire source of an American operation which is discussed and dis-

missed in the text in a few words. The price of the book is explained by the fact that the text is visualized by no less than 161 photographic illustrations, depicting varieties of deformities, operative steps, and a number of end results. The mechanical make-up of the book is in the usual excellent style characteristic of all Maudrich publications.

THEORIE UND PRAXIS DER KREBSKRANKHEIT (Theory and Practice of Cancerous Disease). By Privatdozent *Dr. Felix Mandl*, Assistant at the Second Surgical University Clinic of Vienna. Cloth. Price: 8 marks. Pp. 144. 28 illustrations. Vienna: Wilhelm Maudrich (American Agency: Chicago Medical Book Co., Chicago), 1932.

When one considers that there is no lack of monographs, large and small, on cancer, and when one contemplates the fact that we have no scientifically established etiology of and only surgical and radiologic therapy for cancer, one must wonder why authors persist in adding cancer monographs to an already overstocked book market. This was the prejudiced attitude of the reviewer before he opened the pages of Mandl's book. But he did not have to read very far to appreciate that while the author has added nothing essentially new concerning either the diagnosis or treatment of the malignancies, he has very skillfully organized a very readable and practical exposition of the entire cancer problem, giving in a nutshell all that a general practitioner must know. But even surgeons and radiologists will find many valuable hints in the various sections.

Mandl is peculiarly qualified to present a really practical manual, because as a pupil and assistant of the great master-surgeon Hochenegg and later as an instructor in Professor Denk's clinic in Vienna he has gathered a vast experience which he has sifted with care to render it digestible for the students. The present manual is the outcome of the special courses he has held. The book is divided into a general and a special part. The former treats the problems of etiology, prophylaxis, symptomatology, treatment, pre- and post-operative care, recurrences and metastases in general, while the latter deals with the malignancies of special parts and regions of the human body. The author does not discuss therapeutic technics, but gives specific therapeutic indications, with especial reference to their comparative values, prognosis, and curative results. Thus the reader may take up the problem of cancer of the rectum, to cite an example, and find a reliable review of the operative methods that have been tried and their mortality and recurrence rates, thus bringing to the reader the benefit of the experiences gained in the great Vienna clinics. This applies also to all other forms of cancer. Needless to say Mandl is an enthusiastic advocate of electrosurgery. The book contains 28 excellent illustrations, is well printed on excellent paper and equally well bound. An alphabetic index concludes the volume, which merits translation in English.

INTERNATIONAL ABSTRACTS

Electrosurgery. Dwight B. Shaw.

The Radiol. Review, 56:25, (Feb.) 1934.

After a rather careful review of the subject, the author concludes as follows:

Although too few a number of cases are recorded in this paper to arrive at any definite conclusions, the writer's experience has convinced him that the permanent results following the use of electrosurgery with radium, are better than when radium alone is used in the removal of malignant growths about the face and other conspicuous parts of the body. It is the opinion of the writer that the use of electrosurgery has a definite place: First: In the removal of lesions where a soft pliable scar is desired, especially about the face. Second: In the removal of malignant growths where it is advisable to seal the lymphatics and blood vessels and thus prevent spread. Third: In the surgical treatment of very vascular areas, as for example, liver tissue or removal of tissue for biopsy. Fourth: Procedures in conjunction with other surgery. In our hands, electrosurgery has proved a very beneficial adjunct to our armamentarium of surgery and we believe that in the future more and more uses for electrosurgery will be found.

Newer Methods in the Treatment of Prostatic Obstructions. Russell A. Hennessey, and Alfred D. Mason.

New Orleans M. and S. J., 96:480, (Jan.) 1934.

The author reviews the subject in detail and describes the equipment now available for prostatic resection. The facility with which prostatic resection can be accomplished recommends it particularly as a prophylactic measure. If early micturitional difficulties, such as increasing loss of force of the urinary stream, urinary frequency, and nocturia were recognized and heeded early and subjected to the relief possible by resection, the late devastating effects of prostatic hypertrophy would be obviated and prostatism would become an obsolete clinical entity.

The preoperative, operative and postoperative courses are detailed as are the end results. In summarizing their report the authors state:

1. The amount of tissue that may be removed by transurethral resection is limitless, and must be determined through experience by the operator. The soft adenomatous gland requires the widest and most liberal resection, while the fibrotic or carcinomatous prostate usually requires the least.

2. Transurethral prostatic surgery is not a minor surgical procedure. Preoperative care is as important as though the patient were being

prepared for prostatectomy. The method is not one for the casual instrumenteur, but should be undertaken only by those whose urological and surgical training qualify them to exercise judicious discrimination in the selection of cases and supply prompt decision in an emergency.

3. We feel that transurethral prostatic resection is a most important and paramount addition to our urological equipment, and that it should imbue us with a great sense of comfort in abiding senescence.

Office Treatment of Rectal Diseases. H. H. Wheeler.

J. Ind. S. M. A., 27:10, (Jan.) 1934.

Wheeler reviews the usual office procedures in the treatment of some rectal diseases. He emphasizes the value of examination, preparation and anesthetic, and then names the diseases amenable to office methods. He discusses the injection treatment of hemorrhoids and writes concerning electrosurgical methods as follows:

"The electrothermic methods used for the destruction of hemorrhoids are desiccation and coagulation. The application is made by the use of an electrosurgical clamp or a pointed active electrode. Any well recognized diathermy machine that delivers a steady current and a spark of sufficient intensity will be suitable for this work. The monoterminal current is sufficient for the removal of most hemorrhoids of medium size, and is not so dangerous in the hands of the inexperienced. I have made limited use of the electrothermic method in the treatment of hemorrhoids and find that it is an excellent method when cautiously used. The size of the hemorrhoids, the amount of tissue to be destroyed, and the depth of the coagulation are all to be taken into consideration, and the anatomical parts and sense of proportion must be evaluated. Very little after pain will be experienced when the subhemorrhoidal tissues are infiltrated with benacol. The hemorrhoids can be removed singly a few days apart and the individual permitted to continue doing light work. However, to arrange for a rest over the week-end relieves the nervous strain which always accompanies any operative procedure. This should be insisted upon when at all possible.

"Enlarged papillae that require removal, and inflamed crypts that need drainage, may be easily treated through the anoscope. The high frequency desiccating current can be used to an advantage here. By the use of a curved reflow needle through a bakelite anoscope, the pectinate tissues may be anaesthetized without the pain of a needle prick, and the desiccation of a papilla or crypt completed while the patient lies quietly

wondering what is being done. It is remarkable with what ease and safety a rectal polypus can be removed by the electrothermic method. An insulated snare is thrown around the polyp and the base coagulated. The remaining manipulation is similar to that of a tonsillectomy without the danger of hemorrhage. Bleeding must be scrupulously guarded against when excision is the method used for removal."

Hemangioma of the Eye. Excision by High-Frequency Knife. W. W. Babcock.

Surg. Clin. North America, 12:1411, 1932.

A young man, twenty years of age, was struck in the left eye with a baseball nearly ten years before examination. The swelling had subsided, but a small lump remained. Two years later the patient suffered another blow to the eye. The lump then became red and pulsatile and was definitely larger on exertion and smaller when at rest. The diagnosis was an arteriovenous communication resulting from injury in which a contiguous artery and vein were divided.

Several attempts at treatment had been made. Injections of quinine and urea, alcohol, and surgical excision had been tried. At this time a flap on the lower eyelid was turned down and the larger vascular channels located and ligated. The mass itself was removed by means of the high-frequency knife. — A. J. Cancer, 19, (Oct.) 1933.

Hyperpyrexia Baths and Epilepsy. The Chemical and Physiologic Responses of the Body to Hyperpyrexia Baths, and Their Significance in the Epileptic Syndrome. Helen Hopkins.

Calif. and West. Med., 39:364, (Dec.) 1933.

The effect of hyperpyrexia baths upon the human organism is one of augmentation of cellular excitability developed upon the basis of alterations in chemical and physiologic equilibrium. The present discussion has been confined to these changes as they concern the functional activity of the nervous system. By the use of this measure, latent neurologic and psychic abnormalities have been made apparent.

The experimental use of hyperpyrexia baths in the study of convulsive disorders has been of practical value in the localization of the central pathology, and has shifted some of the clinically functional cases into the organic group. One outstanding example comes to mind of an adolescent girl who, after investigating the nature of her symptoms and in the absence of positive neurologic findings, was classified as a functional case. A major convulsive seizure was elicited by the bath and unquestionable unilateral localizing signs were brought out. Subsequent encephalographic study after lumbar air injection confirmed the localization and revealed an extensive unilateral atrophy of the cerebral cortex.

In view of the percentage (15 per cent) of hy-

perpyrexia baths resulting in convulsive reactions in well-known cases of the epileptic syndrome, it should be borne in mind that failure to induce a seizure does not rule out the possibility of epilepsy, while positive results are not only of diagnostic value, but frequently lead to the localization of the lesion.

Because of the property possessed by high temperature baths of augmenting nervous excitability, and of transposing latent into manifest neurologic signs, this experimental method can be offered for the study and diagnosis of a wide variety of disorders of the nervous system. The experimental investigation of the changes effected within the body by hyperpyrexia baths should lead to a better understanding of excitability, and to the discovery of the mechanism for the beneficial influence of fever therapy upon specific disease conditions.

Five-Year Cures in Cancer of the Mouth, Lip, Nose, etc. Ferris Smith.

Surg. Gynec. and Obst., 56:470, 1933.

The author presents in tabular form a list of 15 five-year cures of cancer of the lip, cheek, antrum, palate, tonsil, face, mandible, eyelid and vocal cord. All were well developed or extensive lesions; nearly all had previously been treated by escharotics or radiation. In addition there were 7 patients with squamous-cell lesions who lived beyond the five-year period but died later of secondary lesions. Of the 15 patients, 7 had node enlargement and 10 had either local invasion or metastases. The methods employed included surgery by scalpel and electrocoagulation, usually combined with radiation.

The total number of patients treated is not included in this report and relative percentages of cures are not mentioned. The author's experience has led him to the opinion that radium has only occasional value in squamous-cell lesions, and that coagulation in association with mass removal of the involved area produces better results. — A. J. Cancer, 19, (Oct.) 1933.

A Five Year Report on the Use of Surgery and Radium in the Treatment of Severe Leucomas of the Cornea. H. L. Hilgartner and Henry L. Hilgartner, Jr.

Texas State M. J., 29:325, (Sept.) 1933.

The authors offer a preliminary report on 23 cases of cornea opacities treated with radium and surgery. In their opinion, total transplantation of the cornea under present methods is quite futile and is wrought with a great deal of danger. Meyer Wiener's operation was performed, and about two weeks after the operation, radium treatments were started. The operative procedure as well as the method of applying the radium is described in detail. The article is supplemented with several case histories.

The Surgical Treatment of Arthritic Joints. Earl D. McBride.

Southwestern Med., 17:321, (Oct.) 1933.

The joints which respond best to forced manipulation are those where the joints are sound but are limited in motion by extra-articular adhesions, such conditions as are commonly termed traumatic arthritis, or stiffness from long-continued immobilization. The guiding principle is, whether or not the joint itself is biologically sound. Erosion or disintegration of the joint elements usually prohibit manipulation. Joints which do not respond favorably to manipulation are those affected by tuberculosis, syphilis, gonorrhea, or proliferative (rheumatoid) arthritis. The following rules summarize treatment by manipulation:

1. Limitation of movement due to a general arthritis, however mild, is characterized by pain in every direction. Limitation due to adhesions suitable to breaking down has a certain degree of painless movement and pain commences only when this is exceeded and adhesions are stretched.

2. When pain and swellings have subsided is the time for manipulation, not before. Delay means increase in strength of the adhesions, and increase in atrophy of the associated muscles.

3. Massive adhesions due to inflammation have a very poor prognosis in respect to forcible manipulation.

4. Never attempt to break down adhesions in a joint affected with suppuration or in the neighborhood of such a process.

5. In the manipulation, use steady force in one up and one down motion, not short jerks. In less serious cases full range of motion may be obtained at manipulation. In more resistant cases, it is better to force the joint through a small arc at the first sitting and make subsequent attempts in the same careful manner.

6. Be very careful to support shafts of bones above and below the joint.

7. Keep joint at rest for a day or so following manipulation. Follow by physiotherapy.

8. Appropriate splinting of an arthritic joint often is a very effective remedy. Relaxation may be secured and the inflammatory process allayed by the rest.

In the third type of case, sound surgical judgment is necessary in respect to the choice of operative procedure. Any joint can be safely opened and reconstructed. The ancient fear that losing the "joint water" would cause stiffness, often blocks the way. The more common surgical measures for relief of arthritic joints are: (1) synovectomy, (2) arthrodesis, (3) arthroplasty. Indications for these surgical procedures are determined by routine examination and accurate diagnosis of the existing condition.

Synovectomy is indicated in partially ankylosed joints which are painful as the result of diffuse, inflammatory and proliferative changes resulting in liping, bony spurs in the synovial tissues and cartilages. It is more specifically applicable to monarticular lesions, as the knee and hip joint in old people, where conservative treatment for relief of painful motion has been exhausted.

Our Experiences with Short Wave Diathermy. E. Raab.

Fortschr. a. d. g. d. Roentgenstr. Beiheft, 46: 101, 1932.

Short wave diathermy has been used at the Gynecological Hospital of the Charity in Berlin for one and one-half years. 4 m. wave applications were not successful, since resonance conditions could not be maintained. The dosage difficulties were overcome by use of a 14 m. wave. No physical or therapeutic differences were noticed between these two different wavelengths. Good results were obtained in inflammations of the adnexa and the parametria, with temperatures from 38.8 to 40.5 degrees C. produced. No injuries of any kind have been observed.

Radiation Therapy In Inflammatory Processes. C. A. Wilcox.

Texas State J. Med., 29:310, (Sept.) 1933.

The author points out that it is a well known fact that radiation is effective in conditions other than those in which destructive action on tissues is desired. A review of the work of well known workers discloses success in such varied conditions as pertussis, gas gangrene, trophic nerve conditions, cellulitis, nose and throat conditions and many others. Wilcox recommends the use of small amounts, single or few treatments, and suggests that the radiologist be more frequently consulted, remembering that the more acute the condition the quicker the response.

Electrical Method for Use in Diagnosis of Diseases of Thyroid Gland. M. A. Brazier.

Lancet, 2:742, (Sept. 30) 1933.

Brazier developed a method for studying the impedance of the human body to an alternating current. He terms the electrical characteristic of the human body which is under investigation the "impedance angle." In constant current work the impedance of the body can be measured by a single factor — the resistance; but with alternating currents the body functions not only as a resistance but also as a condenser. The ratio of these two factors is a property of the dielectric under observation (in this case the body), and it is a function of this ratio which shows variations in thyroid disease and which is defined as the impedance angle. The patient sits on a chair with each arm immersed to the elbow in arm baths containing 10 liters of a 1 per cent solution of sodium chloride at a temperature of about 25 C. The results are unaffected by variation of the temperature of the baths, by slight movements on the part of the patient, by the emotional state of the patient or by the strength of the current passing through the body. No preparation of the patient by resting or fasting is necessary and only a slight degree of co-operation is required. When the arms have been immersed in the baths, an alternating current sufficiently low in intensity to be imperceptible

to the patient is led through him into a simple bridge circuit. The impedance offered by the patient to the current can be balanced on the bridge by adjustment of a variable condenser and a variable resistance, and the impedance angle can be calculated from the readings. Study of the normal subject shows that the impedance angle remains almost constant from day to day in the same individual and that normal groups give only a small standard deviation about the mean for the impedance angle. The values for men and for women fall into two defined groups, the women giving higher values. In order to determine whether there is a significant departure from the normal mean in cases of thyroid disease, 120 women were examined. The results indicated that in thyrotoxicosis there is a marked deviation from the normal, giving high values for the impedance angle—values which in nearly all cases are far outside the standard deviation of the normal group. A comparison of the means for the groups of primary thyrotoxicosis and secondary thyrotoxicosis with that of the normal women and with the mean of a group of patients having nontoxic goiter shows that the increase in the impedance angle in thyrotoxicosis is so great that even the means for these two groups are greater than twice the standard deviation of the normals. The author observed that the severer the disease the higher the impedance angle, and in this way the impedance angle can be correlated with the basal metabolic rate. The impedance angle is not dependent on the basal metabolic rate. It has been shown that in the absence of a thyroid factor the impedance angle is independent of the basal metabolic rate, but in all cases in which the basal metabolic rate is raised by thyrotoxicosis, by thyroid feeding or by the injection of thyroxine or thyroid, the impedance angle also will be raised. In this way the impedance angle proves a more specific test for thyroid disturbance than does the basal metabolic rate. — J. A. M. A., 102:329, (Jan. 27) 1934.

Cause of Death in Accidents Caused by Electricity. S. Koeppen.

Munch. Med. Wochschr., 80:1815, (Nov. 17) 1933.

On the basis of studies on dogs and rabbits, Koeppen assumes that the central nervous system is not impaired directly by the electric current but rather by way of an irritation of the circulatory system. He also points out that, since the cranium provides great resistance, direct impairment of the brain seems hardly possible. Registration of the respiration and of the cardiac activity revealed that the electric current paralyzed first the cardiac system and, after that, the respiratory center. The electrocardiogram discloses cardiac fibrillation. Anatomic investigations show that a disturbance in the

cardiac vessels predominates. The author reaches the conclusion that death from an electric current is death from impairment of the cardiac vessels. The observations are important for the treatment, in that they indicate that artificial respiration alone is not sufficient and that the disturbance in the cardiac vessels requires medicinal therapy.

Artificial Sunlight in Minor Ailments. E. J. Macintyre.

Brit. J. Phys. Med., 8:22, (June) 1933.

Reports that at Bermondsey (England) Solarium, children suffering from malnutrition and debility have been treated by generalized exposure to artificial sunlight with the result that the great majority showed satisfactory gains in weight, increased vitality, general improvement in nutrition and color, and freedom from minor symptoms. A well-balanced diet is, of course, a necessary part of the treatment of such cases, but it was found that the use of cod-liver oil did not affect the rapidity or the degree of improvement in children who were treated by irradiation. In the author's opinion, "the chemical action of the oil cannot replace the mechanical stimulating influence and general physical effect of the exposure of the nude body to ultraviolet rays and mild air currents." Colds and mild catarrhal conditions are treated by ultraviolet rays applied locally by means of quartz applicators and general body irradiation. Rheumatic children are definitely benefited by the artificial sunlight treatment. The circulatory system becomes "more competent" under the light treatment. Adult patients with arteriosclerosis have been definitely benefited, with relief from pains, head noises and giddiness. As the excretory system may have "an extra burden to bear" because of the increased metabolism resulting from the light treatment, the treatment must be carefully graduated if there is any sign of renal disease. The author has found that recovery from acute nephritis is hastened by treatment, but that cases of chronic renal disease with gross albuminuria do not react well, and should be excluded from treatment.

The Reticulo-Endothelial System after Irradiation of Tumor in Mice. A. Cola.

Str. Ther., 46:529, 1933.

After total irradiation with mild x-ray doses, resistance against the growth of transplanted tumors in mice is increased. The resistance towards transplantation reaches a maximum about one month after irradiation. After exposure the mice exhibit increased function of the reticulo-endothelial system. Total x-ray treatment after the implantation had no marked effect upon the tumors and did not increase the reticulo-endothelial activity. Local irradiation of the tumors with mild doses did not affect either the tumor growth nor the reticulo-endothelial system. Only by excessive doses are toxic effects produced.

DIATHERMY IN AMBULATORY GYNECOLOGIC PATIENTS *

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Alfred J. Kobak, M.S., M.D.; Leon Krohn, M.D.

CHICAGO

Gynecologists have only recently come to recognize diathermy as a useful addition to their therapeutic equipment. Most of their zeal and energy had heretofore been enthusiastically devoted to surgery as their major, if not sole means of treating diseases of the female genitalia. The pendulum was swung back to conservative therapeutics by the realization that inflammatory masses involving the pelvic structures can undergo complete resolution. This knowledge has greatly restricted the indications for the removal of the tubes, ovaries, and uterus. Although topical heat had been employed for many years with favorable results, it was appreciated that its penetrating value was small. The ability for heating the deeper structures therapeutically gives diathermy a definite place in diseases of the female pelvic organs.

Diathermy had been introduced to medicine many years before gynecologists conceded it a place in treating certain pelvic disorders. Over-enthusiastic claims by pioneer physiotherapists, on one hand, and over-conservatism by gynecologists on the other, had to be overcome. Less than ten years ago, gynecological textbooks devoted little or no space to this method. With the development of the Corbus⁽¹⁾ and Chapman⁽²⁾ electrodes non-surgical diathermy made great strides in gynecology. The active interest of specialists is attested by the increasing literature in this field. Today standard text books of gynecology give much space to diathermy. With modern diagnostic precision, its indications and contraindications are being more firmly established.

Our attention has been focused on the use of diathermy for the ambulatory patients. We have treated chronic pelvic infections, gonorrhea, and cervical diseases by this method. Cherry,⁽³⁾ and Gelhorn⁽⁴⁾ found that inflammatory masses may be very favorably influenced by medical diathermy. The inflamed

tissues decrease in size or even disappear; pain is relieved, and operations may be either avoided or rendered technically less difficult. Here the Chapman electrode or its modification is of great use. Büben,⁽⁵⁾ Scheffey and Schmidt⁽⁶⁾, and Dittmer⁽⁷⁾ (quoted by Gelhorn), likewise report favorable results.

An attempt to revive heat therapy in treating pelvic infections has recently been made by the protagonists of the Elliott treatment (Holden⁽⁸⁾ and Gurnee). This consists in delivering heat to the vaginal mucosa by a distensible bag into which heated water is introduced. It was shown that with 130 degrees F. in the vagina, the cervix proper is heated to 112 degrees, the anterior rectal wall 104 degrees, the posterior rectal wall 104.2 degrees, and the bladder 104.2 degrees. To compare this with the smooth current flow of diathermy, one may refer to Gelhorn's study in the same year (1931) and note that by the high frequency current a vaginal temperature of 110 degrees F. gives rise to a rectal temperature of 109.2 degrees, and a bladder temperature of 108 to 109 degrees F.

Treatment of gonorrheic patients was one of the first in which diathermy was thought to have a direct lytic effect on the organism. It was pointed out that as the gonococcus is destroyed in *vitro* at 41 to 43 degrees C., the same result could be easily obtained by diathermy. Such factors as greater resistance in *vivo* and the inaccessibility to the organism in certain portions of the genitalia were overlooked. Kolischer,⁽⁹⁾ and Scheffey and Schmidt⁽⁶⁾ deny the thermolytic theory of diathermy, and believe that active hyperemia with decrease in stasis and the attendant increase in antibodies to the focus of treatment are the factors responsible for the beneficial results of diathermy. Sufficient heat to destroy the gonococcus in *vivo* might also be injurious to the tissues of the patient. Williams,⁽¹⁰⁾ Boland,⁽¹¹⁾ Fleishman,⁽¹²⁾ Lindemann,⁽¹³⁾ Corbus and O'Connor⁽¹⁾ and others have studied the effects of diathermy in treating urethral and cervical gonorrhea.

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* From the Mandel Out-Patient Clinic of the Michael Reese Hospital, Chicago.

Minor surgical diathermy is very useful in some of the common gynecologic lesions. Ward⁽¹⁴⁾ recommends it for condylomata, bartholinitis, and skenitis. Fowler⁽¹⁵⁾ illustrates the many uses that diathermy may be applied to in major and minor surgical procedures. Erosions and chronic inflammations of the cervix have been treated very effectively by simple cautery. With the development of the Ende,⁽¹⁶⁾ Cherry,⁽³⁾ Hyams⁽¹⁷⁾ and Remington electrodes, treatment of cervical lesions by diathermy has been simplified. An unbiased comprehensive evaluation of simple cautery and high frequency coagulation or excision, however, has yet to be reported. According to Frank,⁽¹⁸⁾ and Peterson,⁽¹⁹⁾ the treatment of vesico-vaginal and recto-vaginal fistulae by high frequency currents gave most gratifying results. Cases resisting surgical plastics were easily cured by a simple technic.

Most of our patients were seen in one of the six out-patient gynecologic dispensaries of the Mandel Clinic. We first began to use diathermy two years ago, and our present report is limited to sixty-two patients whom we were able to keep under satisfactory control. The treatments to the cervix were given in the clinic. The medical diathermy treatments were given in the physical therapy division of the Michael Reese Hospital under our supervision. We are indebted to our social service workers and the physical therapy division for their deep interest in this work.

Technic and Clinical Results

Medical diathermy treatments were given to thirty-two patients. The number of treatments varied from four to twenty-five, the general average being ten treatments per patient. The average time for each treatment was forty minutes. The active electrodes used were those designed by Corbus, or Chapman. The former was used in treating active Neisserian lesions of the urethra and cervix where the smears were positive. The Chapman electrode, while also used in patients with positive gonococcus smears from the cervix, was used in treating pelvic infections such as parametritis, salpingitis, tubo-ovarian inflammation, and for varying degrees of adhesions involving the pelvic organs. The inactive electrode consisted of the Cumberbatch belt when the Corbus electrode was used, and an anterior plate with the Chapman electrode. This anterior plate is of blocked tin varied in its

dimensions and shape, depending upon the anatomic location of the lesion, and the degree of involvement of the tissues.

The results of our series of thirty-two cases of medical diathermy are summarized in Table 1. Our small Neisserian group of five

TABLE 1—Pelvic Diathermy—32 CASES

	No. of Cases	Cured	Im- proved	Not Im- proved
Localized Neisserian				
Infections	5	3	2	—
Pelvic Adhesions	12	3	8	1
Pelvic Inflammations.....	15	3	8	4
Total	32	9	18	5

cases, all of whom were seen early in the process of the disease with positive smears, responded favorably. Three patients were cured according to all accepted standards, and two patients showed marked improvement. Of the two cases listed as improved, one patient left town before the completion of the therapy. It must be understood that the usual local medications and home irrigations were also employed, and in this sense the diathermy treatments were an adjuvant to the usual routine. The remaining patients treated by diathermy were also given standard local and general therapy. Pelvic adhesions were diagnosed in thirteen of our patients. Ten of these women were post-operative cases. Four patients were cured and eight were improved. Only one case showed no improvement, and she refused consent to a laparotomy. All of these patients had some degree of pain in the lower abdomen. Twelve were definitely relieved. Nine complained of dysmenorrhea, and seven were relieved. Six had menorrhagia and five were relieved.

Pelvic inflammatory lesions were the chief findings in fifteen of our patients. Three were secondary to gonorrhea. Three cases were cured and eight were definitely improved. Four cases showed no improvement. Pain was present in some form in all and was relieved in eleven cases. Dysmenorrhea was present in six cases and relieved in four. Menorrhagia was present in six cases and relieved in only two. Only one patient in this group was subsequently operated upon, and two others were also advised to submit to laparotomy but refused.

The patients listed in the groups of adhesions and inflammations may be further analyzed from the standpoint of anatomic find-

ings after diathermy treatments. Those listed as cured were free from their original local findings as well as subjective complaints. There were sixteen in both groups listed as improved. Eleven of these were practically relieved of all symptoms and had very little local evidences of their previous pelvic pathology. According to former standards of indications, these patients would have been advised to submit to surgical procedures, but this was obviated.

Minor Surgical Diathermy

Our series of thirty cases of surgical diathermy treatments to the cervix is presented in Table 2. The cervix was coagulated in

TABLE 2
Coagulation of Cervix—29 CASES
Desiccation of Cervix—1 CASE

Technic	No. of Cases	Mod- erate Bleed- ing		—Results— Healed Not Healed		Remarks
		Slight	Bleed- ing	Healed	Not Healed	
Cherry Tip..16	2	1	1	15*	2	*Cervix of 1 patient had to be coagulated twice by this method.
Ende Tip.... 6	....	....	....	4	2	1 Cervix cauterized at a later date. 1 patient had polyps.
Bi-Terminal with Dispersing Electrode on Abdomen or Sacrum	4	1	1	4	....
Remington Tip	3	....	....	3	....	1 patient had febrile reaction for 2 days with moderate parametritis.
Monopolar Desiccation..	1	....	....	1	....	Cervical erosion with moderate sized polyps.
Total	30	3	2	27	4	

twenty-nine cases and desiccated in one. The method originated by Cherry was used in sixteen patients. Two had slight bleeding and one bled moderately. Fifteen healed completely and two failed to heal. The cervix of one patient had to be coagulated twice before it healed, hence listed in both groups. Six were treated with the Ende tip. Four were healed and two did not respond favorably. Of the two failures, one was cauterized at a later date, the other patient was discovered to have polyps. No bleeding occurred in this group. Four cases were treated using the biterminal with a dispersing electrode on the abdomen or sacrum. One had slight and

one moderate bleeding. All four healed completely. The Remington electrode was used in three cases, all of which healed satisfactorily. One of these patients had a febrile reaction for two days with a moderate parametritis. Monopolar desiccation was used in one of cervical erosion with moderate sized polyps and healed promptly.

The original purpose of making a comparative analysis of the different methods of coagulation is not feasible at present because of the small numbers treated with the electrodes on the market. However, it might be stated that the results of all were uniformly good and compare favorably with thermocautery which is very popular at present with gynecologists. It has been our custom to advise the use of antiseptic douches for one week before using surgical diathermy. This has been done to avoid, if possible, infections of the pelvis after coagulation. In none of our series was there any serious hemorrhage following this treatment. Most of the healed cases, examined one or two years later, persisted in the so-called cure. The cervixes treated had erosions of varying sizes, and chronic endocervicitis with Nabothian cysts. Desiccation was also used in treating one patient with urethral caruncle. Topical application of 2 per cent cocaine was sufficient for anesthesia in this case. After two such treatments the caruncle disappeared and with it her symptoms of dysuria.

Summary and Conclusions

Sixty-two ambulatory gynecologic patients were treated by diathermy. In thirty-two patients medical diathermy was used as an adjunct to the usual local and general therapy. The results of these treatments proved favorable in most instances. Gynecologic laparotomies were avoided in many instances. We advocate the use of medical diathermy for chronic pelvic infections and pelvic adhesions. Surgical diathermy, especially coagulation of the cervix, gave results that were uniformly good. Cervical plastics were avoided by this treatment in several instances.

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ENDOCERVICITIS AND PELVIC INFECTIONS *

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Endocervicitis and pelvic inflammation are encountered in about 80 per cent of patients. They vary in intensity from a comparatively mild to a severe state. The customary topical treatment has often failed to afford these sufferers a sufficient degree of relief to render their existence bearable. The profession is still confronted with the problem of attaining better therapeutic results than have been seen from applications of medicines by tampons, douches, etc. Surgery, too, has not infrequently failed in removing the trouble for the obvious reason that the real focus has not been removed.

Various types of procedure have been presented from time to time to eliminate cervical infections. Of all the procedures the method devised by Sturmdorf was probably the most successful, judging from its popu-

larity. Its success is attributed to the fact that it is sound in principle, that it removes the infection completely, leaving little scar tissue, and restores the anatomy to almost normal function.

The electric cutting current has now come into recognition as a method having the virtues of the scalpel and the hemostat. Hyams, in 1928, reported 189 patients on whom conization of the cervix was performed with excellent results by means of the cutting current. Since then I have been using Hyam's method with similar good effect. Perhaps the results of the Sturmdorf operation are as good as the conization with the cutting current. The Sturmdorf operation, however, means a considerable expense to the patient, because it requires hospitalization and the use of a general anaesthetic. Conization with the cutting current can be performed in the office with a topical anaesthetic applied to the cervical

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canal, involving very little time or expense. The majority of individuals who need this operation are reluctant to submit to hospital operative measures, because the expense and operation appeared out of proportion to their ailment. I have found, however, that women will readily and fearlessly submit to conization because it is attended with very little disability, a small expense, and accomplished in a few minutes.

Pathologic Changes Encountered

An interesting fact about endocervicitis and pelvic disease is their similarity of origin and its rapid progress throughout the genital tract. The primary focus of infection is always the cervix. From there the infection ascends into the uterus, Fallopian tubes, ovaries, and parametrial tissues. Opinion varies as to the manner of spread, whether by continuity or by the lymphatics.

The normal anatomy of the cervical canal, the numerous rugae, and the intermittent recesses, invite and harbor pathologic bacteria. They gain ready entrance to the cervical glands, and once in the glands, the infection soon involves the entire structure. Since these glands extend through the mucosa and basement membrane to the muscular layer, the mucosa and its basement membrane are virtually honeycombed by the infection. The mucosa becomes infiltrated, indurated, and swollen. The extent of this causes a distortion of the mucosa and its basement membrane, due to its increase in bulk. It is crowded for space, and being limited by the muscular layer peripherally, the external os gives way, and the lips of the cervix become inverted. The external os instead of being covered by smooth, squamous epithelium, we now find this epithelial covering pushed peripherally and an infected cervical mucosa taking its place. This macerated, indurated, infected cervix, with localized areas of necrosis, is what is commonly called "erosion of the cervix."

As the inflammation becomes chronic in the infected cervix, we also find cervical glands, whose lumina have become occluded with mucous and debris, or covered with epithelium during the process of the inflammations, forming cysts, commonly known as Nabothian cysts. These add to the size of the already bulky cervix causing even more eversion.

With this brief picture of chronic endocervicitis we can readily see how the coniza-

tion method eliminates all the abnormal tissue when the cervix is cored out to the muscular layer. The removal of this tissue is not mutilating, because the only functional tissue removed is the mucous secreting cervical glands. However, these glands are already so extensively damaged by infection that there is little possibility of ever having them regain normal function, hence they are not a direct loss. Furthermore, if left *in situ* they will be a source of continuous reinfection.

The normal process of repair, according to Frank, constitutes the elimination of the affected glands and replacement of the injured columnal epithelium by stratified, squamous epithelium. Hyams found that following conization, the cervix is relined by stratified, squamous epithelium. With the muscular layer intact, the cervix returns, practically, to its normal condition.

Endocervicitis would not be the problem it is today were it not for the dangers of the spreading of the infection upward to the uterus and adnexa. This upward invasion may occur at any time during a menstrual period, at delivery, following lacerations or instrumentation of the cervix, and other conditions where the local tissue resistance is decreased. Practically all of the infectious diseases of the pelvic organs gain entrance to the pelvis through the cervix. The bacteria need not wait for an opening, they can also spread by escaping into the lymphatics. The more virulent forms set up a series of acute inflammatory changes along the route of the lymphatics which make their way through the uterus, tubes, parametrium and ovaries, even involving the pelvic peritoneum.

In women that have suffered from pelvic cellulitis resulting in adhesions and inflammatory changes within the pelvic organs, the bacteria from the glands of the cervix find fertile material for infection in adjacent parts. The local resistance being continuously weakened by the bacteria from the cervix, there is set up a chronic induration in the scar tissues which causes discomfort and pain requiring urgent intervention.

In most of the cases that I have treated by conization this pelvic pain cleared up spontaneously following the operation. In others, in whom the pain persisted, I have been able to relieve their symptoms by subjecting them to several diathermy treatments through the pelvis, placing an electrode of block tin over

the lower sacral region and a mesh electrode over the lower abdomen.

Conclusions

1. The cause and source of endocervicitis and pelvic infection must be removed.
2. Conization of the cervix is the best method we have at the present time.
3. After the infected area is removed,

diathermy through the pelvis is the most efficient treatment to eliminate the persistent inflammation which sometimes continues after the cause has been removed.

4. I believe conization and diathermy in treating endocervicitis and pelvic inflammations are an improvement over any other form of treatment.

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PATHOLOGY AND TREATMENT OF ENDOCERVICITIS *

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The object of this paper is to urge the more general adoption of non-surgical therapeutics of diseases peculiar to women. There is a vast field for such a line of treatment, provided it is based on sound pathology and correct diagnosis. Gynecology is particularly well adapted for the extensive use of electrical and other physical methods.

Chronic endocervicitis is an inflammatory process involving the cervical tissues, particularly the lining membrane of the cervical canal. It is due to the presence of bacteria. It is a distinct pathological entity apart from endometritis. We believe that the uterine cervix is a most important factor in pelvic pathology and most resistant to satisfactory treatment. This is conceded by gynecologists, and is confirmed by my own extensive experiences. Located at the gateway between the infected vagina and the sterile endometrium, parametrium and peritoneum, it is in a constant state of turmoil for the major part of a woman's life. Through its lumen and its rich lymphatic supply must pass the materies morbi, the cause of most of the infectious conditions of the uterus, the tubes, the ovaries, and the parauterine structures. The cervix, furthermore, is the seat of 90 per cent of all uterine cancers. Like the teeth and tonsils the cervix may be the seat of focal infections. There lurks around the cervix a tentative feeling of impending disaster, and not without reason,

as a close study of this most important segment of the uterus will reveal.

The Uterus and Adnexa

The particular setup of the cervical mucosa makes accretion of infection easy. The uterus is made up structurally of a neck or cervix and of a body or corpus. The length of an adult virgin uterus is 3 inches with a cavity of 2 inches. The cervix forms one-third of the organ. After childbirth the uterus is always a little larger, the cavity measuring two and one-half to three inches. In multiparous women the cervix is slightly shorter in proportion. After the menopause there is marked atrophy of all the genital organs, including the uterus.

Histologically the cervix is covered and lined by epithelium with an intervening stroma of smooth muscle, connective tissue and elastic fibers. The canal is lined by a single layer of high, narrow columnar epithelial cells with nucleus at the base—picket fence—epithelium, set directly on the fibromuscular stroma with numerous thrusts into the stroma in the form of racemose glands secreting an alkaline mucus. The cervical canal terminates abruptly at the internal os, and the lining epithelium precipitously changes to endometrium. At the external os the transition is equally as abrupt into squamous epithelium covering the vaginal portion of the cervix. This squamous or pavement epithelium, like the vaginal mucosa has no hornified layer, sweat, or sebaceous glands.

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 12, 1933.

Within 48 hours after birth the lower vagina contains organisms and never relinquishes them throughout life; organisms which gradually ascend even in the virgin until the cervix is reached. Curtis demonstrated the fact that bacteria are not found above the internal os, and asserts that the cervical glands are very susceptible to infection, with a strong tendency to become chronic. The breaking down of this protective barrier is an important item. This may be accomplished by direct infection such as the gonococcal, which is the most frequent, or the spreading upward from the vagina or vulva of non-gonococcal infections. Traumatata such as occur during labor and abortions greatly facilitate and augment cervical infection. The non-pathogenic vaginal bacillus of Döderlein, which normally occupies the upper part of the vagina and furnishes a protective acid medium may be swept away or destroyed by uterine discharges, vaginal douching, pessaries, and the use of contraceptive measures.

Cervical Infection

The incidence of cervical infection is very large. In upwards of 6,000 women successively examined, Fulkerson found a little more than a third had cervical infections and that the condition existed in 78 per cent of all cases between 20 and 40 years of age. Other authorities differ but little in their estimates of its frequency, and it is safe to say that, alone or in combination with other lesions, it is present in 70 to 85 per cent of all patients.

The term endocervicitis cannot be strictly applied. For although the infection first starts in the cervical endometrium, it soon involves the adjacent musculature and tissues immediately surrounding the cervix, through the rich lymphatic supply leading through the parametrium to the tubes and ovaries. As Leopold demonstrated: "The uterine and cervical lymph current may be traced from its lacunar origin in the cervical and corporeal mucosa through minute funnel-shaped ostia directly into the myometrium. Here it branches into an extensive capillary network which spreading on the permysium, penetrates and enmeshes every bundle and fascicle of the entire uterine musculature to its subperitoneal surface whence it drains into two main collecting channels that course parallel to the uterine and ovarian blood vessels at the base

and top of the broad ligament. In short, we have chronic ascending lymphangitis with its resulting impairment of uterine, tubal and ovarian function, that links the pathology and symptomatology of chronic endocervicitis, and not by a primary endometritis. In fact, the vast preponderance of all infections of the pelvis viscera the cellular tissue, tubes and ovaries arise primarily in the cervix. Owing to the particular makeup of the metrial lining and its constant change through the menstrual function, the endometrium is not so easily affected."

Treatment of Cervicitis

The essential thing to consider in the treatment of cervicitis is the infection in the racemose glands. These glands normally secrete mucus but when infected secrete pus or mucopus. They are buried away in and under the mucosa. No vaginal douche can get at them. No topical application in sufficient potency can be made to penetrate the deep recesses of these ramifications. It remains then to destroy this germ infested lining of the cervix. The idea is a good one, were it not fraught with the hazard of a cicatricial contraction of a degree sufficient to interfere with adequate drainage, for drainage we must have. The application of destructive chemicals has been tried, but if powerful enough to reliably destroy the pyogenic membrane would excite so much inflammatory reaction that a firm non-elastic cicatrix would result. Realizing this situation, mechanical removal of the infected area in some fashion seemed to be the only recourse. The method most frequently used is amputation or some form of plastic surgery of the cervix. Amputation, like in other parts of the body, admits defeat and the breaking down of our therapeutic resources. Trachelorrhaphy or some kind of coring operation, of which the Strumdorf is a type, while fairly successful in removing the erosion and most of the leucorrhea, so mutilates the womb as not to allow it to function normally afterward. Amputation and extensive plastics damage the womb by removing the protecting influence of the cervix and allowing vaginal bacteria to the endometrium, a place they are not supposed to be. The cicatricial tissue that forms in the cervix disturbs the delicate mechanism of dilatation by involving the musculature, thus producing a rigid os with an increased tendency to tear at subsequent la-

bors. Owing to the surgically produced inelasticity of the cervix, sterility is encouraged and in case of pregnancy, abortion after three or four months is in my experience the rule. Like many other diseases whether of the personal body or the body politic, multiplicity of remedies presages difficulty of cure. Lack of unanimity in the treatment of cervical infections is woefully apparent, largely because in our eagerness to develop major surgical technic, we have neglected the consideration of a series of conditions that are far more destructive to the health and lives of women than our operations were calculated to correct. Harsh surgery has had its day. More conservative measures must be adopted. No normal tissue should be sacrificed. To remove or mutilate a functioning organ for the eradication of a minimum of disease is not good practice.

Of course classic surgery has its place and an important one in gynecology. Neoplasms in most instances are best disposed of by surgery. Badly infected tubes and uteri need surgery, and in no case is the demand for reparative surgery more insistent than the damaged pelvic floor due in most cases to childbirth.

Until very recently about the only gynecologic therapeutics taught was surgery. It is largely even so today. We still hear the reverberation of the animated discussions regarding the merits or demerits of various fancies of stitch or twist to restore a retroverted uterus, in itself probably symptomless unless it carries an infected cervix.

Ask the gynecologic surgeon what remedies he has available aside from surgical interference, and he will probably reply, douches and tampons. Ask the general practitioner about his remedial resources and he will probably say that he applies iodine to the eroded cervix, boroglyceride on tampons, and perhaps a lysol or salt water douche and uses sedatives for dysmenorrhea, ergot for hemorrhage, and pessaries for prolapse.

Of course, it is obvious that drugs, endocrines, general hygiene, and health building and constructive psychology must form the background for the betterment of woman's physical and mental condition. But after all is said and done there remains a definite barren gap that can be best filled by the many forms of electrotherapy.

Galvanic Ionization

I shall confine my remarks to the consideration of the galvanic current in this paper. The galvanic current is the oldest, simplest, most efficient and versatile. The outfit to produce the current is inexpensive and the results are definite and dependable. For more than a century the absorption of drugs through the skin and mucous membrane by the passage of the galvanic current, the so-called electrolytic absorption, was a fascinating subject. Within certain well defined limits the electric current may be used to force chemicals into the tissues in sufficient potency to be therapeutically effective. There are, however, various factors involved in its transfer — the amperage used; the time of application; the resistance of the tissues; the migrational velocity of the entering ions and also its chemical nature.

The conducting media of the electric current are aqueous solutions of acids, bases, and salts. These substances or electrolytes are dissociated or split in water into their constituent atoms or groups of atoms called ions, which carry a positive charge of electricity. The point of entrance of the current is the anode or positive pole and the point of exit, the cathode or negative pole. Solutions of electrolytes contain ions and molecules all in dynamic equilibrium among themselves and in constant motion. With the passage of a current through such a solution, a rearrangement of the ions results at once. Substances differ in polarity, and the effects on the tissues at the two poles are very dissimilar. The tissue around the cathode is destroyed by alkaline caustics. The coagulum formed is relatively soft. Around the zinc or copper anode the tissue is destroyed by neutral caustics and the coagulum is firmer and harder and tends to adhere to the metal. Cumberbatch says: "The distance to which the tissue is destroyed around the electrodes depends on the distance to which the ions migrate. Even if the current flows for a considerable time the distance is not materially increased because the ions combine with the tissue proteins. The albuminates of these metals are insoluble, and offer an increasing resistance to the current as they increase in amount. The greater the degree of dissociation of the solute the greater the facility with which the current travels, since the conductance of a solution is due to the

dissociated parts of the molecules. This resistance may be overcome by increasing the dilution, until a certain point is reached where dissociation is complete and the maximal value of electric conductance is obtained. This serves to demonstrate the fallacy in the use of concentrated solutions." (Hittorf.)

Turrell of England, and W. L. Clark of America both agree that ionic medication is indicated in local conditions. Clark concludes that the application of the galvanic current alone, without the use of remedial drugs, is of benefit in various pathological conditions, due to the interpolar ionization of the tissue constituents, thereby altering nutrition, improving metabolism and producing stimulation or sedation.

Following this trend and the results obtained by Samuel Sloan of Glasgow in gynecology and Friel of London in the ionization of otitis media, I have made extensive use of ionization in endocervicitis. With the ions in solution we feel that better and prompter results are obtained than with the solid stick. The solid stick produces more of a caustic effect in the immediate vicinity and does not permit the ions to penetrate as deeply into the recesses of the infected racemose glands.

Technic for Cervical Ionization

The patient is placed in the dorsal position, with the knees drawn up and the table tilted so as to considerably elevate the hips. A medium sized glass Ferguson speculum is passed into the vagina and the cervix fitted into the upper end. The os is cleaned and dried. A zinc sound is passed into the cervical canal for about one inch or one inch and a half. The speculum is half filled with one-half of one per cent of zinc sulphate solution. The zinc rod is then connected with the positive pole and the negative pole attached to a wet pad over the lower abdomen or under the buttocks. The current is slowly turned on and raised until the milliamperere meter reads 15 to 20 milliamperes and allowed to run for 10 to 15 minutes. By this time the os and cervical canal will be seen to be coated with a thick white deposit. The current is turned off and the sound removed. A loose vaginal pack is sometimes inserted for 12 hours. If the leucorrhea is profuse I dust a wool and cotton tampon with some mild antiseptic powder. I prefer to use the tampon very sparingly as I think it prevents free drainage. This

treatment is repeated every 5 to 7 days for three or four weeks, in which time, unless the case is of the most aggravated type, I expect the condition to have cleared up. No vaginal douches are allowed and intercourse is discouraged during the time of treatment. Only external washing with soap and warm water is recommended. Some backache and low abdominal tenderness is often complained of for a day or two. I usually advise women to rest during this time and lie down as much as possible. Most of the patients subjected to this treatment had been complaining of vaginal discharge for years and experienced every type of treatment without relief.

With this as with any other form of intracervical treatment I must advise that extreme caution be observed in approaching these cases. Remember the close proximity of an infected cervix both anatomically and etiologically to the pelvic viscera. A correct diagnosis of the exact status of the uterus and its appendages must precede any intracervical manipulation. Otherwise an unexpected flareup in the form of severe pain and inflammatory reaction will result.

The application of the principle of ionization to the cervical canal by means of solid metal electrodes is much easier of manipulation, but in my experience the curative results are not so prompt or lasting. Solid metal ionization is indicated in the class of the milder chronic types of endocervicitis with not too extensive erosions. The more aggravated cases with bad lacerations, hypertrophy due to deep seated infection, whether covered with erosions or not, are best dealt with by electrocoagulation or electric coring with the cutting current.

For application of the solid metal electrode to the cervix a bivalve vaginal speculum is introduced. The vagina and cervix are cleansed with soft soap or tincture of green soap. By the way these preparations are by far the most satisfactory for general vaginal cleansing and besides soap and alcohol are admirable antiseptics for various vaginal infections. The cervical canal is cleansed with this tincture of green soap applied on a cotton wrapped probe. If the secretion in the cervical canal is very viscous I introduce a cotton wrapped probe dipped in powdered sodium perborate. Soon after the application a pinkish foam rolls out of the os. The cervix must invariably receive a thorough pre-

liminary cleansing and I find this is the best way.

Two or three points of importance have been insisted upon by Dr. Tovey of the New York Policlinic. The electrodes on the market are too long and so he has devised a set that is nearly an inch shorter. This I long ago found to be the case but I had the terminal third ground off. The old instruments were made when electricity in gynecology and endometritis was the fashion. Another fundamental emphasized by Tovey is the tight fitting of the electrode to the cervical canal. After the metal terminal has been adjusted, it is connected with the positive pole, the negative pole being connected to an appropriate wet pad on the abdomen or under hips. The current is gradually turned on until fifteen to twenty milliamperes are registered. It is allowed to run for 15 to 20 minutes, when the current is turned off and the instruments are removed.

The removing part is a matter of considerable importance. First we will find the electrode stuck firmly in the cervical canal and the external os surrounded by a greenish deposit of copper. I know operators who advise the forcible pullings of the copper electrode out of the cervix, claiming that this strips off a considerable portion of the diseased endometrium. The process while theoretically sound is the cause of great pain and is usually followed by marked peritonism. To get the electrode out easily I reverse the current for a few minutes, which softens the stiffened albuminates and allows the electrode to fall out. When reversing the current one must be careful to do it slowly, otherwise the patient will complain of pain and stinging under the abdominal pad. The negative pole is more irritating than the positive. Pricking under the abdominal pad is frequently due to insufficient wetting or to lack of uniform contact. The latter may be secured by placing a sandbag on top of the dispersing pad or having the patient make wide pressure with the hands. If pricking is noticed the patient instinctively lifts the pad. Caution her about this and tell her that if she does anything without notifying the nurse, it should be to make gentle pressure at the point of pricking. Another annoyance during the active part of the treatment sometimes complained of is colic, often severe. This I find to be due to the jamming of the electrode against the in-

ternal os, or to too strong a current. These things can be easily rectified. Otherwise the entire séance can be experienced without discomfort. Outside the physician's own meticulous technic most of the comfort of these treatments is due to an experienced and tactful nurse.

Erosions of the aggravated type, hypertrophy of the cervix with embedded cysts, lacerations and erosions, are best treated by electrocoagulation and ionization. Many cases, however, improve markedly under ionization. This is due to the clearing up of the higher infection. How erosions are formed is described by Strachan:

The columnar epithelium is stimulated to grow out of the cervical canal by the sub-epithelial infection, the tissues become hyperemic and edematous with redness and swelling of the cervical mucosa. The vaginal mucosa is lined right up to the external os with stratified squamous epithelium. This pushing down and out of the columnar epithelium raises the squamous epithelium at the external os from their bed and being cast off, leaves a red, raw circle around the os. The racemose glands are carried out along with the epithelium, and may proliferate greatly, producing the condition described by Eden and Lockyer as pseudo-adenoma, and usually called an erosion. It is not an ulcer. The ducts of the racemose glands become blocked by inflammatory products or constricted by periglandular fibrosis, and the acini dilate forming retention cysts, which burrow in the cervix and may finally emerge on the vaginal surface, the so-called Nabothian cysts.

In the light of this pathology the fallacy of cauterizing the external erosions without first dealing with the primary cause is apparent. We are every day seeing the results of this enthusiastic cauterization, in the form of cicatricial contraction of the external os. The primary infection is not cured, but is bottled up, with often increased pelvic distress, ready fatigue and anemia due to focal infection in the cervix. Obstetricians are meeting with these cicatricial cervixes in increasing numbers. Here we recommend electrocoagulation or coring with the cutting current. The description of these procedures as practiced by me, was presented as a paper read at the State Medical Society of Wisconsin and published in the *Wisconsin Medical Journal*, September, 1931, also in a paper read at the Omaha meeting of the American Congress of Physical Therapy and published in the *ARCHIVES* of March, 1932.

Finally it is my contention that no one line of treatment or procedure is effective in cur-

ing all forms of endocervicitis. No set of instruments, however, complicated can hope to meet all of the requirements in more than a small proportion of cases. The large number of cases reported is usually taken from a public clinic. Primarily they do improve, but the end results are hard to follow. This is in sharp contrast to private cases.

Discussion

Dr. Irving F. Stein (Chicago): This symposium has presented such a variety of clinical experiences that it perhaps would be well to discuss them in detail. Gelhorn has given us a rather concrete summary of the value of medical diathermy in pelvic inflammations. I agree with this authority that medical diathermy is not indicated in the acute pelvic infections, nor in the subacute states, but is useful in the chronic infections, particularly in chronic gonorrheal infections.

Cherry showed that when we attempt to use medical diathermy for fairly acute and subacute puerperal infections, the patients become worse and some of them promptly die. In gonorrheal infections of the pelvis, he found that about 50 per cent were very definitely benefitted, some so much so that no surgery was required, or the patients were so relieved that they refused further treatments. Of the 50 per cent that came to operation, it was found that medical diathermy was definitely beneficial in softening the indurations in the pelvis, rendering surgery very much easier and safer.

Gelhorn emphasizes that the selection of cases be made carefully and that one must be sure to diagnose the pathologic conditions accurately. That advice holds for almost any method of treatment, but should be emphasized again because diathermy is particularly contraindicated in pregnancy, since one must be sure that one does not deal with a tubal pregnancy rather than an inflammatory swelling. The pelvic cellular inflammations as well as the adnexal conditions respond in about 50 per cent of the cases. Perhaps 50 per cent is not so great, but if we can benefit one-half of the patients with extensive inflammatory damage of the pelvis by conservative methods, surely that is very worth while.

Most of us who are in the active practice of gynecology are perhaps not using diathermy enough. The facts brought out in this symposium should stimulate greater interest and encourage us to avail ourselves of this treatment more extensively. At the Michael Reese Hospital we have been particularly interested in the work of Frankenthal, Kobak and Krohn. Their results have been very gratifying. Although their series is small, they have even a larger percentage of relief and cures than Cherry reported. Cherry found in cases of endocervicitis that 50 per cent of the 48 cases were cured by his method, whereas in this group of 30 that were reported here today, 26 were either improved or cured.

I should like to ask that in their closing dis-

cussion they tell us a little more about the appearance of the cervix after the Cherry endothermy: how the patients were followed up in the clinic; how many times they were seen; and how long it took for a cure; what were the instructions to the patients during the recovery period? Personally I have had only a limited experience with the Cherry endothermy or the other methods of diathermy in the cervix. I have used the cauterization method over a period of years, and although I partially agree with Dr. Ground that if one uses it only on the surface one may seal in the infection in the cervical canal, I wish to emphasize that we use it up in the cervical canal, similar to the method that he showed with a long narrow platinum loop, at least an inch in length, so that it can reach into the canal, up to the internal os. It is true that when the cautery tip is up in the canal and there is a thick mucus plug it is difficult to get the proper amount of heat, and also to evaluate exactly how much cauterization is being obtained. However, by dissolving the mucus by means of a solvent, such as caroid powder which liquifies the mucus, thereby drying it, in most cases we are able to get high up.

Sometimes one does get a cystic endocervix following cauterization, because one seals up some of the glands that are not thoroughly cauterized; this may call either for further puncture with the cautery and coagulation, or it may call for a type of plastic such as the Strumdorf, an amputation, or another form of tracheloplasty. The majority of cervixes heal after cauterization. It isn't only a surface healing, and it isn't only a covering over an infected cervical canal. Those patients are well, as evidenced by the fact that they have no further discharge.

I must disagree with the doctor about the end results, when these patients become pregnant and come to delivery. I have never seen a patient who had a cauterized cervix who presented a rigid cervix, or who had difficulty in dilatation when she came to labor. More recently one of our staff members at Michael Rees Hospital has been using the Dickenson type of cauterization in patients during pregnancy who have endocervicitis and erosions. He has not yet had difficulty as far as bringing on abortions is concerned, and the cervix seems to heal in pregnant cases even more rapidly than in nonpregnant cases; he has encountered no difficulty at the time of labor.

Kolischer has warned the profession that in using endothermy and medical diathermy one must not use too high a degree of heat; that if one uses heat that approaches but does not actually coagulate the cells one may cause a precipitation of globulin in the cells and in that way impair their vitality. I think that must be kept in mind.

Cherry brought out the point that in gonorrheal infections a lower temperature is required for destruction of the organism than in streptococcus, staphylococcus, or colon bacillus infections. That is perhaps the reason a higher degree of success is enjoyed in gonorrheal infec-

tions, and why the septic processes following abortion or labor are not benefitted but sometimes aggravated.

I hesitate to discuss the ionization that Dr. Ground so well presented, because I have had no personal experience with it. I would say, from his experience and his presentation, that it undoubtedly deserves a just place among the conservative measures in gynecological practice. I think the strongest point he made in his presentation is the fact that one must individualize the treatment of the cervix. One must not be narrowed down to a single method of treatment. If one man uses only the cautery, the next man only ionization, and the next man only the Cherry endothermy, there is bound to be a number of failures due to the fact that one has not looked upon the condition in a broad enough light. Individualization will show that a certain number of cases are applicable for each type of treatment, and there are always a certain number of cases that must be treated surgically. A turned-out cervix that is due to laceration is not particularly adaptable to endothermy or cautery treatment. It should be repaired; or if badly infected or markedly encysted, then, of course, tracheloplasty or amputation must be done. The long loop cautery is adequate in getting up into the cervical canal and should not give way entirely to the other methods of treatment.

I do not think this symposium should enter into a discussion of the treatment of cancer by diathermy, although that was mentioned. I do not believe that surgical diathermy is adequate as a single method of treating cancer of the cervix. I think, however, that surgical diathermy may be a very valuable adjunct in the treatment of cancer of the cervix. In many inoperable cases the arresting of hemorrhage, the destruction of necrotic and foul masses may be attained. The men who formerly advocated a combination of surgical diathermy and radiation for the most part have dropped diathermy as a preliminary method of treatment. Curtis no longer uses it. The tumor clinic at Michael Reese Hospital definitely advises radium in preference to diathermy and without diathermy as a preliminary. That is, of course, an opinion and not a dictum. The classical treatment of carcinoma is still in the formative stage, and I think none of us is so wise we can say the last word about it.

Chairman Holman: Dr. Stein has said that he should like to have some report on postoperative treatment. What little experience I have had in treating these cases has been predominately in postoperative cases. As I am associated with a clinic, and doing just what my experience dictates, I have treated these cases as I saw fit. I have treated quite a good many postoperative cases and chronic inflammatory conditions. I have found that if you treat those who have acute inflammatory lesions too soon you may stir up some joint symptoms.

I have come to the conclusion that if the women would realize what diathermy would do for them in pelvic conditions, the physician would

be too busy to relax. That has been my observation, and it seems that the biggest factor was the improvement in the general condition of the parts. As an illustration, a lady 27 years of age came to me with a seven years history of a double phlegmasia alba dolens. When she came the right leg was still painful and swollen. It was difficult for her to get up and downstairs. She had been to a number of physicians who gave her a guarded prognosis. She wanted relief and I treated her with diathermy. After 26 treatments she was completely relieved. She is now a perfect example of a normal woman.

Dr. Alfred J. Kobak (closing): We have shown that certain types of dysmenorrhea are favorably influenced by the use of diathermy. Before using such treatments in painful menstruations one should determine whether or not the difficulty is based on some organic condition. Pathogenic lesions such as those underlying pelvic infections, or bands of adhesions may cause anatomic changes in the uterus, parametrium, and adnexa, with subsequent passive congestion. On the other hand, dysmenorrhea may exist in women who have no pathologic findings in their pelvic organs. This we recognize to be the so-called functional or idiopathic dysmenorrhea. Diathermy can hardly be expected to influence this condition. Here one is dealing with some disturbance in the physiologic process which may not be in the pelvis. Gynecologists are securing splendid results with hormone therapy in treating functional disturbances of menses.

I agree with Dr. Stein that electrocautery has given good results in erosions of the cervix. Our results with electrocoagulation of the cervix have likewise been very good. Our series of coagulations are too small to make comparative evaluations. When we first attempted coagulation of the cervix we found that our early failures were due to lack of sufficient depth in coagulation. We used the Cherry electrode in most of our cases. One does not have to be so careful in the removal of mucus secretion when using diathermy because this substance will adequately conduct the current. On the next return of our patient we noticed that the coagulated tissue was separated from the portio vaginalis by a narrow zone of granulation tissue. The coagulated tissue sloughs off in 10 to 14 days leaving hyperemic granulation tissue where the cervix had been coagulated. This healed completely in a period of 4 to 5 weeks in most of our patients. The cervixes in some of the patients we saw a year or two later had remained well. We hope to continue with these studies and be able to evaluate a large series of patients treated by medical or surgical diathermy.

Dr. William E. Ground (closing): I was present in London a few years ago when Drs. Cumberbatch and Robinson were working out their technic on the treatment of gonorrheal infections in St. Bartholomew Hospital. I know with what meticulous care they worked out their technic, and their results in the gonorrheal infections and in some of the more acute infections were due to the excellent care given these patients.

Cumberbatch also called attention to a lot of our arthritic conditions in women, especially in women about the time of the menopause. Painful, creaky joints would very often yield to diathermy in the cervix, ignoring the joints. He made a point of that. The source of your infection for those arthritic conditions is in the cervix. He treats the cervix, and he reports very good results.

In treating these cases the question of diagnosis must be arrived at with great care. To put any kind of an electrode into the cervix without being sure that you have no tubal infections is a great mistake. I have been doing this work for a great many years. I have had the same nurse and the same personnel in my office for six or seven years, and we have followed this work up quite closely. We have had flareups using all the care possible. Every once in a while some woman will have lower abdominal pain and develop a little fever. She will be compelled to keep to her bed for a few days, but I do not know that we have had any real tubal abscesses.

After these treatments the pain is often considerable. When we treat these women in our offices we cannot send them home to go about their regular work. Frequently they must rest for a few days. So that as far as pain is concerned, most of these surgical diathermy treatments are not devoid of pain, particularly when you are working around the internal os.

The electrode that I use is a flexible bulb type, and I can heat the upper portion of the cervix. There is all the difference between the coagulation of high frequency and the actual cautery. We know that it is the heat that is a curative

agent, and not the electrode. Heat is one of the best sterilizers that we have, so that it is very logical, it seems to me, to apply heat in the cervix. Of course, as I said before, we treat the milder cases with ionization.

With reference to hemorrhage in coagulation, while we have had some bleeding, we have never had any considerable bleeding. In a case or two we have been called in to make some special applications. So far as the anesthetic is concerned, prior to the electrocoagulation I dip a cotton tipped probe into a 2 per cent solution of novocain, and I leave that for about 10 or 15 minutes. That does as much as anything I know of to alleviate the pain. It has the toxic quality dose for dose that cocaine has and it is just as positive and as satisfactory.

I am the only essayist who really advocated the cutting current and the conization in preference to the coagulation, and so I want to mention a few reasons why I prefer the cutting to the coagulating current. No doubt with either method you destroy the infection, and that is what you want, but with the coagulating current you produce quite a bit of destruction of tissue, and it takes a couple of weeks for that to slough off, and the patients in the meantime have discharges. With the cutting current you cut out the tissue and you get very little slough.

In many of these cervical infections you find a laceration of hard, fibrous tissue. I have been using a loop electrode and cutting out the scarred tissue, practically doing a trachelorrhaphy in the office, and almost painless. The large, boggy surface that is there after the scarred tissue is removed will shrink, and it is not necessary to suture it after the scarred tissue is removed.

Pacific Physical Therapy Association

The April meeting of the Pacific Physical Therapy Association will present the following program:

1. Present Status and Possibilities of Physical Therapy in the Field of Urology:

By: Elmer Hess, M.D., Erie, Pa.

Discussion by Arthur B. Cecil, M.D.; Elmer Belt, M.D., and James C. Negley, M.D., of Los Angeles.

2. Hyperpyrexia.

By: Rodney F. Atsatt, M.D., of Santa Barbara, Calif.

Discussion by J. Ross Moore, M.D.

3. Sacro-Iliac Conditions, and Their Treatment.

By: T. E. P. Gocher, M.D., of San Francisco, California. Medical Advisor, Aetna Life Insurance Company.

CHRONIC FOCAL INFECTION *

JAMES W. WILTSIE, M.D.

BINGHAMTON, N. Y.

Since Rush and Billings^{(1), (2), (3)} first called attention to chronic focal infection as a factor in disease, the concept has passed through the usual vicissitudes of all new theories. Complete understanding of the intricate problems involved and a rational therapy could come only after years of study and observation. We are just now beginning to appreciate its significance and elevate it to the importance it merits.⁽⁴⁾

In the past chronic infection has been too narrowly considered.⁽⁵⁾ Obvious foci were removed or drained and the patient was expected to get well. The possibility of obscure or diffuse foci producing symptoms was never seriously considered. Neither was the possibility that there might be constitutional or other conditioning factors influencing chronicity.⁽⁶⁾ Independent and unrelated foci may be easily eradicated and the menace removed. But when vicious circles become established we are dealing with a chronic condition not so easily controlled. We may now remove or drain all known and accessible foci, but unless we are able to break the vicious circles and influence infection in the colon, liver and biliary system, the lymphatics,⁽⁷⁾ joints, fascial sheaths and tendons, we will not be justified in anticipating a permanent cure.

Symptoms

We know that in many cases in which the microorganisms and the tissues involved are apparently identical, there is a wide variation of symptoms. It may be argued that the microorganisms though apparently identical differ in strain, virulence, numbers, etc. This is true. On the other hand in chronic states the tissue reactivity is much more likely to be the determining factor in variability. Therefore foremost among the conditioning and contributing factors to chronic focal infection stands immunity,⁽⁸⁾ allergy and tissue drainage.

Factors Influencing Infections

All infections fundamentally imply a struggle between the invaders and the defense

mechanism of the host. There are three possible results: destruction of the invader, destruction of the host, or chronic infection in which neither force is wholly able to overcome the other. Immunity has been inadequate but it has held the invader in check. On the other hand the invader intrenches himself but gradually loses in virulence. As time goes on the tissues of the host may become sensitized to the toxins of the invader. Tissue reactions now become exaggerated, and we say that the patient is in a state of allergy. Among the symptoms of chronic focal infection are anemia, lassitude, loss of weight, anorexia, dizziness, variation in blood-pressure, insomnia, headaches, physical and mental depression, tendency to taking cold, etc. Such conditions as arthritis,⁽⁹⁾ asthma, colitis, eczema, hypertension, some spastic states, and possibly others although commonly the result of focal infection, are essentially allergic in nature. Our problems multiply therefore according to the degree in which allergy enters as a factor.

Natural tissue drainage is a very important factor in the determination of chronic infections. If drainage from an infected area is free and unimpeded, the infection will automatically clear up unless fed by some other focus behind it. I have many times observed spontaneous disappearance of pyelitis following correction of a colon infection. However, this will not occur in the presence of ureteral spasm or stricture. Frequently free drainage is interfered with by allergic reactions in and about the tissues. In these cases desensitization must accompany any active therapy designed to improve drainage.

Many spastic conditions are the result of psychic influences such as environmental maladjustments, worries, etc., also of instability or imbalance of the autonomic nervous system, endocrine disorders and other forms of constitutional inadequacy. Other factors that may influence chronic infection are dietary deficiencies or indiscretions, posture, exhaustion, etc.

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 15, 1933.

Rational Treatment

Effective therapy must take into account all these factors and must therefore be planned with the greatest care for each individual, separately, after a most painstaking examination. The first consideration is always rest and improved elimination by all natural routes. A well chosen diet with sufficient calories, high vitamin content and adequate fluids is the next. Careful yet sympathetic inquiries into mental and nervous factors must be made and their influence on the condition explained and when present removed if possible, for many times these factors alone are responsible for chronicity, operating by virtue of their effect in producing spastic states and stasis.

The origin, history, probable mode of development and scope of the infection should be worked out, as upon this study will depend our method of attack. The teeth and tonsils frequently present themselves as the probable primary foci. When incriminated they should be surgically removed. It must be born in mind, however, that these foci have probably been pouring the products of their activity into the general circulation by way of the lymphatics for some time. Otherwise there would be no symptoms. The heart and lungs receive this infected blood first. Beyond the heart are the capillary beds of all the organs and tissues of the body. Theoretically any of these may now become the seat of secondary foci.

We must remember, however, that dilution in the blood stream must be very great and that the liver receives and purifies the blood in large amounts. Whether these foci originate directly from the primary focus or are the result of infection by organisms that have withstood the bactericidal action of the liver after this function has been injured, is an open question. In any event the liver is always involved in chronic focal infection and must therefore be considered as a secondary focus. In the presence of the primary or other secondary foci it now becomes the crucial link in a vicious circle.

With impaired function and infection in the liver it is not long before the biliary system becomes involved. The bile then carries infection into the bowel, adding new strains to the fecal flora. Long before this, however, there are indications of colon stasis due to the

depressing effects of toxemia on the transport mechanism of the colon. The indigenous flora of the colon becomes altered under these circumstances with the result that certain strains assume a pathogenic rôle without the necessary addition of any new strains from above or below.

However, with the addition of new strains from the biliary system the cecum and colon become foci of major importance. Toxins and bacteria readily enter the portal circulation and add tremendously to the burden already placed on the liver, enhancing thereby the pollution not only of the general circulation but of the bile itself. Thus a second vicious circle is initiated. The lymphatic drainage from the ileum and colon through the mesenteric system to the receptaculum chyli and thence to the blood stream becomes a third,⁽¹⁰⁾ for every infected node is a focus in itself. When drainage becomes blocked new groups are involved even to the gastro-epiploic and subpyloric glands.⁽¹¹⁾ In this way much pathology about the duodenum, gall bladder and head of the pancreas may really be secondary to colon infection.

In time the liver becomes chronically congested resulting in portal stasis, hemorrhoids, proctitis and the shunting of large volumes of infected blood through the inferior hemorrhoidal veins to the iliac veins and by this route to the general circulation. This then becomes our fourth and last great circle, but there may be others of minor importance.

It is evident therefore that chronic focal infection, no matter where it begins must ultimately involve the whole body. It must also be evident that the cecum and colon now hold the key position, for until they are clean and functioning normally there can be no hope of relief to the liver which guards the portal to the general circulation. The symptom complex — chronic intestinal toxemia⁽¹²⁾ now dominates the picture.

Intravenous Treatment

When I first began the study of chronic infection many years ago, I was frequently disappointed in the results of surgery and drainage of evident foci. I endeavored to influence infection by autogenous vaccines and non-specific protein therapy. Intravenous injections of sodium iodide yielded a few brilliant results and in addition brought to light many unsuspected foci.⁽¹³⁾ A local reaction

took place followed some time later by a general reaction and an increase in leucocytosis. I studied a series of sixty cases and a few controls which confirmed my original observations. In a few cases of hay-fever and asthma I was surprised to observe a decrease in an existing leucocytosis accompanied by relief of symptoms.⁽¹⁴⁾

My explanation of these findings at that time was that the iodide acting upon the focus promoted a lysis of exudates thereby releasing antigenic bodies which in their turn stimulated the immunity mechanism with a reaction at the focus. I still believe this explanation to be correct in part, for we know that diseased tissues absorb more iodide than normal tissue⁽¹⁵⁾ and we also know that iodides break down hydrated protein molecules thereby reducing the viscosity of exudates.⁽¹⁶⁾

However, the studies of McDonagh,⁽¹⁷⁾ of England, and of Retan,⁽¹⁸⁾ of Syracuse, have provided a more rational basis for the results I had been observing. Tissue fluids contain a higher percentage of crystalloids than blood serum. To counterbalance this the colloids of the blood are higher than those in the tissue fluids. The colloids do not dialize readily through the capillary wall but exert a constant osmotic pressure. The actual diffusion of fluid through the capillary wall then varies directly with the blood pressure and with changes in the crystalloid and colloid content of the blood serum. Blood pressure remaining constant, a hypotonic solution added to the blood would decrease the osmotic pressure in the capillaries and cause an increased flow in the direction of the tissues. A hypertonic solution would cause the reverse.

Retan,^{(18), (19)} studying the use of hypertonic solutions for relief of intracranial and intraspinal pressure, conceived the idea of reversing this process for the treatment of spinal lues, encephalitis lethargica, and other inflammatory conditions of the brain and cord. He injected slowly into the vein large quantities of a hypotonic solution of sodium chloride and simultaneously performed a lumbar puncture and continuous drainage. His results have been spectacular. Experimentally he found that in animals with meningitis the intravenous injection of hypotonic solutions produced a cerebral edema which did not appear when the cord was simultaneously drained. He has observed evidences of edema in other diseased tissues upon introduction of

hypotonic solutions, but never in healthy tissue. The reason for this is that capillary permeability is increased in damaged tissues which therefore are the first to show edema.

Curiously enough the introduction of 20 cc. of a hypertonic solution of sodium iodide influences the osmotic pressure in the same way as large quantities of a hypotonic solution. The mechanism, however, is different. The iodide reduces the viscosity of the blood by dehydration of its colloid particles.⁽²⁰⁾ The osmotic pressure is reduced and an increased flow of fluid takes place into the perivascular spaces about foci of infection. Where lymph drainage is free improvement or cure takes place. Where it is impeded we get local edema, pressure and pain. After twenty-four or thirty-six hours the direction of flow may be automatically reversed due to the reestablishment of normal osmotic pressure within the capillaries. On the other hand an extension of the inflammatory process may take place as a result of the breaking down of nature's protective barrier. In other words the use of sodium iodide intravenously is a method of forced perivascular drainage, of diagnostic and immunologic value, exceedingly beneficial at times and readily controlled if intelligently used.

Irrigation of Colon

After having accomplished all that was possible through the use of surgery and sodium iodide, I still had a number of patients whose symptoms had not materially improved. The only possible uninvestigated area that I could think of was the colon. Theoretically infection here exists outside the body, which would account for the failure of sodium iodide to produce reactions. These cases were treated with high colon irrigations under which they showed marked improvement.⁽²¹⁾

In treating chronic focal infection I now begin with colonic therapy.⁽²²⁾ I do this because I find that the colon and liver are invariably involved and that if treated first many other foci clear up spontaneously,⁽²³⁾ toxic symptoms are relieved, and the patient's resistance is improved. Usually it is unnecessary to do anything else unless it be to remove primary foci when such exist. It does no harm at this time to use sodium iodide intravenously several times as an aid to tissue drainage and to be sure that all somatic foci have been recognized and drained. In arth-

ritis or other allergy, desensitization should now be undertaken by the use of autogenous vaccines. There is really no occasion for the use of vaccines for any other purpose.

Diathermy through the abdomen two or three times a week after the first few colon treatments is of the greatest value. It produces active hyperemia and aids tremendously in drainage of the tissues. It may be given directly over the liver occasionally although the liver derives benefit from any abdominal treatment as it receives the portal blood. The gall bladder and biliary system should be drained by the duodenal tube or in some other way periodically, as it is useless to treat the colon alone just as it is useless to drain the biliary system alone. It is true, however, that the high colon treatments indirectly benefit the liver and if given over a sufficiently long period of time it will be found that the liver and biliary system have drained out and purified themselves as do the lymphatic systems following the removal of foci that feed them.

Summary

Chronic focal infection is a systemic disease differing widely in its symptomatology and manifestations according to the relative prominence of its several etiological factors and conditioning influences. Successful therapy must take into consideration such measures as removal or drainage of discrete foci, natural and forced drainage of all infected organs and tissues, desensitization, rest, nutrition, elimination and finally management of each individual according to his own special requirements. The methods of choice in carrying out these measures are those of most direct approach, viz.: surgery, physical modalities for drainage, autogenous vaccines for desensitization and the special application of a few selected drugs as indicated.

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THE PRE-RADIUM TREATMENT OF UTERINE CERVICAL MALIGNANCY *

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Most surgeons and gynecologists are now agreed that once a definite diagnosis of uterine cervical cancer has been made, its further management is best by radiation treatments. The possible exception is the infrequent Stage growths, in which surgery or radium may be used with equal success, or in the comparatively rare cases of adenocarcinoma.

Examination

Patients should first be carefully examined not only to determine the extent of the local disease, but to ascertain the general condition. It is especially necessary to determine whether any metastatic malignancy is present, and if the patient is in condition to receive radium treatment. It is important that the gynecologic examination be done gently; rough examinations have a tendency to disseminate the disease. The local physical findings as determined by the gynecological examination furnishes a convenient classification for a study of the disease. In making the gynecologic examination, it is important to determine whether the uterine canal is patent, and if so, to ascertain and record its length (by means of a sound). A biopsy of the lesion should be done at this time. Biopsy carries insignificant hazards in cervical cancer because the lymph and blood channels are already blocked by the ulceration which is invariably present.

Classification of Patients

Before considering the method of treatment, the stage of the growth should be classified, in order to provide a convenient means for discussing the therapy. A practical classification of growing popularity is the one proposed by Henry Schmitz, and is based entirely upon the local physical findings.⁽¹⁾ Carcinomas are divided into primary and

secondary or recurrent lesions. The factors which determine the grading of the primary carcinomata are as stated in the following groupings:

GROUP 1 comprises the earliest lesions, which unfortunately, are the least frequently seen. The growth is the size of a navy bean, is clearly localized within the cervix, and the uterus has normal movability. (A uterus normally movable can be displaced downward by ordinary force without causing distress to the patient until the cervix appears at the vaginal outlet, when pulled by a tenaculum forceps attached to the cervix.) This group is sometimes called "operable."

GROUP 2 includes cases in which there is a wide or peripheral invasion of the cervix or body of the uterus, a doughy consistency of the paracervical tissues, and decreased mobility (evidenced by failure of the uterus to be completely displaced downward when pulled by a tenaculum forceps). This group is often called "doubtfully localized" or "borderline."

GROUP 3 includes cases in which there is infiltration of one or both parametria, with or without regional lymph node involvement or invasion of adjacent organs, but the structures are, as a mass, still somewhat movable, though elasticity of the tissues is lost. This group is sometimes called "advanced" or "inoperable," and is the condition most commonly present when the patient is first seen for radiation treatment.

GROUP 4 cases are characterized by absolute fixation of the tissue (the "frozen pelvis"), wide local extension of the disease, (invasion of neighboring viscera) or distant metastases. This group is usually designated "terminal," "fixed," or "inoperable." The "complicated" carcinoma is one associated with general disease in a patient who is considered a poor surgical risk.

The characteristics of the groups in the recurrent carcinomata (following hysterectomy)

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¹ This classification closely resembles the one proposed by the Cancer Committee of the League of Nations in 1929.

tomy) are: Group R 1 is the local but normally movable recurrence; Group R 2, the regional but movable recurrence; Group R 3, the cases with local and regional movable recurrences, and Group R 4, the recurrence, with fixation of the mass.

Since the use of radium in uterine cancer is a hospital procedure and the patient is usually not acutely ill, there frequently occurs some delay until consent has been secured. Many women will delay some weeks "getting ready" to go to the hospital. What treatment should the patient receive in the interval? Should the physician administer no treatment in uterine cervical malignancy until the radium is actually applied?

It is a fact that the majority of patients suffering from cervical cancer, when first seen by the physician, already present an advanced stage of the disease. Schmitz, in his analysis of 332 consecutive, primary cases, found that 49 per cent had Stage 3 growths when treatment was first begun, and 30 per cent had Stage 4 growths—a total of 79 per cent of advanced lesions. Other writers report statistics of about the same proportion.

Microscopic Findings

According to Lacassagne of the Radium Institute of the University of Paris, there are three common varieties of uterine cancer:

1. The squamous cell epidermoids, which are easily recognized by their characteristic malpighian epithelium consisting of stratified squamous cells;
2. the adenocarcinomas, the columnar or prismatic cells of which are arranged in the form of glands; and
3. transitional cancers, consisting of cells which at times simulate the malpighian cells and at times secreting cells. Here must also be included undifferentiated carcinomas which do not offer any identifying characteristics.

Adenocarcinomas make up about 10 per cent of all uterine cancers. They constitute the majority found in the fundus, but make up only 3 per cent of the cervical carcinomas. The remainder of cervical cancers is equally distributed between the epidermoid squamous cell carcinomas and the transitional cell carcinomas.

The importance of the microscopic findings is in determining the therapeutic indications. The percentage of clinical cures, in cases with similar clinical appearances, vary with differences in the histologic structure of the growths. Epidermoid carcinomata furnish the greatest number of clinically cured cases treated by radiation therapy. Transitional carcinomata are the next in order of frequency, a great proportion of them being

clinically cured by radiation. The third and rarest group—the adenocarcinomata, form the smallest number of the clinically cured. According to Lacassagne:

The adenocarcinomas of the uterus, especially of the fundus, are radioresistant and are more frequently complicated by infection than the other types of uterine cancer. The tendency of these neoplasms to destroy uterine muscle may account for perforations and sepsis which sometimes complicate radiotherapy of these cases. The experience with the treatment of these tumors at the Curie Institute has not been satisfactory.

In view of the facts just mentioned, the policy at the Curie Institute has been to treat all adenocarcinomas of the uterus by surgery and all epidermoid or nonepidermoid cancers by radiotherapy. Clinically this means that extensive surgery is avoided and most cases are treated by radiotherapy when dealing with carcinomas of the cervix, whereas hysterectomy is preferred for most cases of cancer of the fundus.

Surgery, however, should never be attempted in Stage 3 or 4 growths, or those presenting a Grade 4 (Broder's) malignancy.

Broder's Microscopic Classification

The grade of malignancy present, in accordance with the histologic classification of Broder, is another important prognostic factor and an aid in determining the type of treatment. Broder classifies cancer cells into four different types or grades, Grade 1 tumors being clinically the least malignant while Grade 4 are the most malignant and rapidly invade the lymphatics. The degree of radio-sensitivity of these tumors has been found to vary with the cell type, Grade 1 being the most radio-resistant and Grade 4 the most radio-sensitive.

In this connection, Healy of the Memorial Hospital, New York City, has remarked: The extreme importance of this observation is evidenced by the statistics of end results in cancer of the cervix under surgical or radiation treatment respectively, especially in Grade 4, the most malignant cell type. Under surgical treatment by hysterectomy 9 and one-half per cent of the cases in this group remain well for five years, whereas under radiation therapy 66 per cent remain well for five years. Thus emphasizing the fact that the extreme malignancy of this type of tumor cell is more than counterbalanced by its marked radio-sensitivity.

Choice of treatment as a factor in prognosis in uterine cancer is much more important than seems to be generally recognized by the profession at large. There still is too great a tendency on the part of the individual surgeon to treat all cases of uterine cancer alike; that is, by hysterectomy and with little or no regard for the histologic characteristics of the tumor or its classification according to Broder's plan.

Under such treatment practically all patients with tumors of the Grade 4 type are condemned, regardless of how favorable for operation the case seems to be.

It is absolutely essential that a preliminary study of the histologic structure of the tumor be made from either a biopsy specimen or material obtained by curettage, in order to determine the kind of therapy that should be employed. All authorities today are agreed that the Grade 4 group of tumor cases should be treated by radiation therapy and not by hysterectomy.

Moreover advanced cases, which form 80 to 85 per cent of all cases of cervical cancer, are entirely out of the surgical group and must be treated by radiation therapy if anything at all is to be tried.

It is worth remembering that under radiation therapy 23 per cent of all our advanced cases were still alive at the end of five years, a really remarkable salvage since the outlook was hopeless as far as operation was concerned when the patient was first seen.

The important factors that influence prognosis and end results in cervical cancer are (1) early diagnosis, (2) histologic characteristics of the tumor and (3) choice of treatment. The importance of these are in the order named, the early clinical diagnosis, i.e., the extent of the disease when the treatment is begun, is easily the most important of all. The value therefore, of an early diagnosis, cannot be stressed too much. The life of the patient largely depends upon this.

Contraindications for Radium

Granting the diagnosis is one of uterine cervical cancer, it is then important to determine whether the patient is in a condition to receive the intra-utero-vaginal radium treatment. There are only a few contraindications. The following are considered absolute:

1. Advanced cachexia caused by anemia following repeated hemorrhages or uremia by compression of the ureters.
2. Very advanced local disease with absolute fixation of uterus and fistula formation.
3. Existence of a serious pelvic and general infectious state that cannot be suppressed.
4. Generalization of the cancer beyond the pelvis.

Palliative radiotherapy by high voltage x-rays can frequently be given in far advanced cases showing cachexia, having general metastases or showing invasion of the bladder or rectum.

Where the local infection cannot be cleared

up, treatment by external radiation should be first undertaken. This is less risky and is frequently followed by the disappearance of malignant nodules and the cicatrization of the ulceration, so that intra-utero-vaginal radium can then be undertaken.

External Radiation

When radium is applied in the uterus or vagina, its ability to successfully destroy cancer cells probably does not reach beyond 2 or 3 cm. from the walls of the applicators. It is apparent, therefore, in Stage 3 or 4 cervical growths, that intra-utero-vaginal radium, alone, cannot be expected to control the condition and that additional radiation from without is also necessary. This can be applied in the form of high voltage (200,000 volts) x-ray treatment, or by means of the so-called radium pack, by which the entire pelvis is cross-fired through a number of different portals. In such advanced cases, the question is, should this external radiation precede the internal radium treatment or not? There appears no doubt but that the extra-uterine involvement is the greatest source of danger to the patient and may result in perforation into the rectum and bladder, or permit the growth to spread beyond the pelvis. It is also true that the outer limits of a tumor are usually the more active in growth. In view of the above facts, would it not appear more logical to administer the external radiation first?

The views of Prof. Claude Regaud, associate of Mme. Curie, of the University of Paris, who has had perhaps as wide an experience as anyone with the radiation treatment of cancer, are interesting in this connection.

Regaud believes that any attempt to reach the parametrial involvement in cervical cancer by radium needles, implants, seeds, and other means, is not good practice. He contends that the interstitial use of radium in this region is dangerous. The simultaneous employment of radium puncture and intra-utero-vaginal irradiation may cause secondary rays excited by the impingement of gamma rays on the platinum needles or seeds. Such beta therapy increases the danger of radium necrosis. Regaud states that the association of x-rays or radium at a distance, with radium applied utero-vaginally, is the correct method when the parametrium is invaded. He contends that if x-rays are used

to give the external treatment, they should always precede the radium treatment, while if external radium therapy at a distance is used (radium pack), it should follow the internal radium therapy.

Pack, in describing Regaud's method, states:

The association of radium therapy and roentgen therapy is for the purpose of securing the combined action of the x-rays (in the peripheral part of the neoplastic territory) and of radium in the uterus and vagina. When the neoplasm has extended beyond the uterus (parametrium, vagina, pelvic adenopathies) this combination is the method of choice and is the rule in the majority of instances. Regaud believes that the order of succession of these two agents is not an indifferent matter. The inefficiency of the x-rays in the treatment of recurrences following previous radium therapy has been shown by Regaud (1923) apropos of epitheliomas of the skin and mucous membranes in general. X-rays are especially inefficient after radium therapy has been given by the utero-vaginal method. To use these agents in the correct combination, roentgen therapy should be administered first, followed immediately, or after a very short period of rest, by radium therapy.

Levitt in his five year report of the Cancer Research Committee of St. Bartholomew's Hospital (London) states:

In growths treated by radium in which the approach is through the natural body cavities, e.g., growths of the cervix, the zone of least intensity of radiation tends to be at the periphery of the growth and it is almost exclusively in this region that recurrences occur. Any means of shrinking the growth prior to the application of the radium would tend to bring the growth more completely within the range of the radium irradiation. That x-rays can in a large proportion of cases cause marked shrinking, and frequently complete disappearance, of a malignant growth was known from previous experience, and accordingly, from this point of view also it was argued that the x-rays should precede the radium.

Cervical Infection

A factor to which many radiologists have not given proper consideration in treating malignancy is the local infection that accompanies so many of these growths. The role of infections in the dangers and complications incident to the use of radium is particularly important in cancer of the uterine cervix. Local infection invariably accompanies cervical cancer at the moment it opens into the vagina. The infection usually advances with the progress of the cancer and probably does as much, if not more, to break down the resistance of the patient as the growth itself. The infection is at first superficial, but later extends deeply, and the infiltrations that one

palpates may be due to infection, new growth, or both. If an attempt is not made to first control this, radium may transform the local infection into an acute pelvic cellulitis, a suppurative salpingitis, a circumscribed phlegmon of the pelvic tissues, a generalized peritonitis, or a septicemia.

The rapidity with which some physicians apply radium, immediately upon diagnosis of a cervical cancer and without any preliminary treatment, is to be condemned. A better procedure is to give copious, warm, mild, antiseptic vaginal douches several times each day until the local infection is controlled. Pack, in describing Regaud's preliminary radium treatment states:

The putrefactive microbes disappear readily under this local treatment, but the pyogens, namely, the staphylococcus and streptococcus, are more difficult to destroy. Autogenous vaccines are responded to by the staphylococci, but the streptococci, particularly those of the dangerous hemolytic type, are very resistant. In every instance where internal radium therapy has been followed by severe pelvic infection, the preceding bacteriologic analysis has demonstrated the presence of hemolytic streptococci: on the contrary not every patient harboring these streptococci within her vagina will suffer this complication.

The ablation or curettage of cancerous vegetations of the uterine cervix has certain advantages; it facilitates treatment; it may suppress the supuration from the infected cervix; it frees the implantation of the cervical tumor from the orifice of the uterine canal; it permits closer approximation of the radium foci to the outlying cancer tissue; it favors cicatrization and lessens the danger of toxemia from absorption. A bleeding, infected, sphacelic, "cauliflower" cervical tumor should be amputated, preferably by diathermo-coagulation, previous to the introduction of the radium into the vagina and uterine canal.

Kaplan, in describing the method used at Bellevue Hospital, New York City, the largest municipal hospital in the United States, states:

Following examination and biopsy, the patient is prepared for treatment. Constipation, from which these patients often suffer, is treated with mineral oil and milk of magnesia, or cleansing enemas. Thorough vaginal douching is given once or twice daily with 2 per cent glucose, salt, or boric acid solution. Radiation is done with high voltage x-rays, alternately, anteriorly and posteriorly, over the right and left pelvis. It is given in 25 per cent doses with one-half millimeter copper and one millimeter aluminum filtration, at distance 30 to 40 centimeters, and over a large field, which takes in the inguinal and pelvic glands, and ovarian areas. The x-ray treatment is administered every day until the total dosage is given. Douching is kept up daily during this radiation period. The diet is light with

forced fluids, especially fruit juices. Immediately following the application of the x-rays, radium treatment is given.

Pinch, in describing the technic used at the internationally known Radium Institute, of London, states:

"Patients suffering from carcinoma of the uterus often present themselves in a condition which negates any attempt at immediate treatment. The cervix, fornices, and vaginal walls are extremely ulcerated, covered with washleather sloughs, and exude a constant, copious, purulent, offensive discharge. It is of the utmost importance to render the diseased surfaces as clean as possible before using radium. Douches of Tr. Iodi, drams 1 to each pint of warm water, should be used two or three times a day, a Ferguson speculum should be passed, and any loosely adherent sloughs detached with forceps or a probe covered with cotton wool. This treatment should be persisted with until all detritus and sloughs have been removed and the discharge is no longer offensive. If the iodine douche proves unduly irritating, glyco-thymoline (1-20) may be substituted for it in the later stages. A douche of Flavine, 1 in 2,500, should be given on the day before, and early in the morning of the day on which the radium is inserted."

At the well known Marie Curie Clinic, London, the preliminary treatment is reported as follows:

The preparation of the patient includes a general examination, a blood count, and urine analysis; when necessary a cystoscopic examination is made to determine the condition of the bladder. A bacteriological examination is important. Disinfection is carried out with acriflavine douches (1 in 1,000 normal saline) twice daily for a day or two before treatment. In advanced cases with extensive necrosis and foul discharge, rest in bed for a few days and a more thorough cleaningup is advisable. In cases of severe anemia the patient is kept in bed for two or three weeks for special treatment before the radium is applied.

During this preliminary treatment the patient, if able, may be up and around. She should be thoroughly examined to determine the extent of the lesion and to ascertain if any distant metastasis is present. X-ray examination of the chest, spine, and pelvis are valuable in ruling out metastasis in these parts—favorable areas for the growths to appear. In addition, every effort should be made to eliminate sources of focal infection and to improve the general health of the patient.

After a week or ten days of preliminary treatment, the cervical canal should be gently dilated by the use of graduated uterine sounds, and the length of the uterine canal noted. The patient is then returned to

bed and her temperature taken at intervals during a period of twenty-four hours. If there is no increase in temperature, the patient is ready for the internal radium treatment.

Preliminary Radium or Electrosurgical Amputation

When the cervical canal is filled with a cauliflower growth, or an ulcerating growth at the external os, and localization of the canal is impossible, the patient should not be given the principal internal radium treatment. Such cases should receive preliminary radium treatment by the embedment of radium needles, implants, or a contact radium application, or the cervix should be removed by electrosurgical measures.

Kaplan, Pfahler and others advocate the amputation of the cervix or the removal of malignant masses by electrosurgical means immediately preceding the insertion of radium in certain cases (a small percentage) of cervical cancer—as when the cervical canal is obstructed by a large cauliflower growth blocking the vagina or there is much hypertrophy of the cervix associated with a large amount of fibrous tissue which may help to shield carcinoma cells. When such treatment is given, preliminary radium treatment is not necessary, as the uterine canal is rendered patent and the principal radium treatment can be readily carried out. Sometimes complete removal is not possible. In such instances, as much growth as feasible is removed, and then radium needles are inserted in the remaining mass. When the mass has receded the uterine canal may be located and the principal radium treatment administered.

If preliminary radium is used, the uterine canal will usually become sufficiently patent in 10 to 20 days, to permit the introduction of an intra-uterine radium applicator. In fact, these cases usually respond remarkably to such preliminary radium treatment. There is a danger that the patient or physician may think that further radium is not necessary because the excrescences are readily cleared up.

Preliminary radium treatment or electrosurgical amputation is absolutely necessary in all cases where the growth has proliferated to such an extent as to occlude the cervical canal, if the maximum results are to be secured. The principal radium treatment should not be given until the uterine canal is rend-

ered patent. Many radiologists are now of the opinion that the best results in cervical cancer can only be secured by treating the entire uterine canal with heavily filtered radium from multiple centers. This necessitates the predetermining of the length of the uterine canal, in order that the proper type of applicator may be provided. If the cervix is to be first amputated, the length of the uterine canal will be shortened and the radium therapist must consider this factor when constructing the intrauterine applicator.

Summary

The following facts in connection with the preradium treatment of cervical cancer should be emphasized:

1. Every case of advanced cervical cancer should receive external radiation and if this is given by high voltage x-rays, it should preferably precede the internal radium treatment.
2. Local infection usually accompanies cervical cancer and no case should receive internal radium treatment until the infection has been controlled by suitable douches, etc.
3. The principal internal radium treatment should not be given until the uterine canal is patent, as the best results are secured by placing radium the entire length of the canal. If the canal is occluded it should be treated by preliminary radium until rendered patent, or the cervix should be amputated by electrosurgical measures.
4. Every effort should be made to eliminate sources of focal infection and to improve the general health of the patient.

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FUNDAMENTALS OF RADIUM THERAPY IN CANCER OF THE RECTUM

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The management of any illness must be individualized by using every available method suitable to the situation, and this applies to radiation therapy in cancer of the rectum even to a greater extent. It is only by keeping this thought ever in mind that our best results are obtained. Our plan embraces four divisions; namely, (1) general constitutional tonic, (2) pre-radium high voltage roentgen treatment of the pelvis and lymphatic drainage areas, (3) radium treatment directly to the lesion, and (4) post-radium treatment.

General Constitutional Treatment

Because of the pain associated with a rectal lesion, many patients refrain from having bowel movements, while others suffer more or less from diarrhea. Most patients, as they present themselves, are weak, thin and dehydrated, and need systemic as well as bowel hygiene. Continuous intestinal drainage is at all times imperative and the bowel must be cleared of impactions. Therefore if there is a reasonable lumen through the mass, daily rectal flushings are given to empty the bowel and liquid petroleum is administered by mouth to provide an easy defecation. Radiation therapy should be employed, when possible, without colostomy, provided the above mentioned drainage can be established. Nevertheless, colostomy is a beneficial procedure, frequently too long delayed. When properly executed, with practically no risk, under local anesthesia, it is far less objectionable than is commonly supposed. After good elimination has been established the diet consists of frequent meals of soft foods of high caloric value, and plenty of fluids. In many cases colostomy is not necessary in order to carry out our treatment. One should irradiate the lesions effectively (conserving the normal bowel tissue as much as possible), and thus avoid colostomy. Further, those cases that are borderline for colostomy can be benefited

by dietary measures and by instructing the patient how to get along with the imperfectly functioning rectum. A low residual, high caloric diet and instructions in the use of the low cleansing enema give much comfort to these patients. The patient or a relative should be told that a colostomy may have to be done at some future time; when necessary, it should be done at an elective time rather than as an emergency procedure. Whenever a carcinoma of the rectum is annular, a colostomy is indicated, because constriction is already present and stricture will soon appear. If at least one-third of the lumen of the wall is free, it is possible to avoid a colostomy.

If the neoplasm is situated in or below the recto-sigmoid junction the fungating mass can be removed by electrocoagulation. A glass speculum is inserted into the rectum to engage the tumor until it is destroyed by the diathermic current. A suction tube introduced into the speculum withdraws the vapor from the operative field.

Pre-radium Roentgen Treatment

After the bowel has been emptied of fecal impactions, detritus and the fungating tumor, preliminary application of a series of high voltage roentgen treatments is given; not only to effect the tumor proper but especially for its effect on the areas of lymphatic drainage throughout the pelvis, the x-rays being directed through two anterior and two posterior pelvic fields, and a perineal portal. The amount given to each area is from one to one and a half erythema doses in quarter doses per treatment, one or two areas being treated daily, depending on the condition of the patient. Following roentgen therapy, radium is applied to the rectal lesion.

Before using intrarectal radiation, it is essential to define the limits of the tumor so that the entire neoplasm may be irradiated. If the growth is so situated or of

such conformation that its upper margin cannot be palpated, its limit of upward extension is determined by passing a proctoscope of small caliber and confirmed by a roentgenogram after a barium enema.

Radium Application

There are three popular methods of applying radium and radon, but to state which technic should be followed for the average patient is impossible; one must use the type of applicator best suited for the lesion under treatment. For accessible anorectal growths efficient irradiation may be obtained with intratumoral gold implants of radium or removable platinum needles of radon, or by applying a surface mask to the tumor. The latter obviates puncture of the tumor, with the possibility of infection and ulceration. When the lesion is in the rectal canal radium is applied to the entire area involved, either by capsules of radon in tandem in a rubber tube if the cancerous lumen is extremely narrow, or by a specially designed hollow rubber rectal applicator if the canal is larger. This latter method possesses the great advantage of enabling one to limit the irradiation to any desired segment of the rectal wall. In treating women, when the tumor involves the anterior rectal wall, the placing of heavily filtered radium in the vagina, or the insertion of needles through the posterior vaginal wall, reduces the size of extensive lesions, thus eliminating, at least in part, the hemorrhage and infection. In other cases a sacral incision, just as in the sacral operation for excision of the rectum, will expose the tumor mass, and radium may be inserted into the lymphatic area. Intraperitoneal radon implants are sometimes mentioned, but I hesitate to use them lest perforation of the bowel ensue and a rapidly fatal peritonitis result. There is a class of cases hopelessly incurable, in which the process involves the anorectum and surrounding structures, "freezing" all tissues into a malignant mass and rendering life utterly miserable. Under spinal anesthesia and after preliminary colostomy, one may rim out widely the entire area by electro-surgery and then apply radium to the cavity. The relief from suffering and the palliation afforded are well worth the effort.

Postoperative Irradiation

Roentgen therapy has been used more or less routinely after cancer operations as a "prophylactic" treatment in an effort to prevent recurrences. The purpose of the treatment is to destroy any cancer cells that may have been left by the surgeon at the operation. Not all surgeons are agreed that this end is accomplished, and it must be admitted that satisfactory proof is not possible for the very simple reason that the presence of cancer tissue before treatment is only conjectural. If the patient does not develop a recurrence, it may be because the surgeon has removed all the cancer tissue and not because the radiation was effective. If a recurrence does develop, naturally the treatment has been ineffective. This set of circumstances presents the subject to the analytic mind in an unfavorable light. It is not helped by statistics that present entirely contrary conclusions as reported by different individuals.

One might argue that when opinions differ the patient should be given the benefit of the doubt and the treatment be given in the hope that it may do some good. The contrary argument is that harm may result from the treatment by lowering the resistance of the tissues and that irradiation in itself is known to predispose to the development of cancer, notably in the hands of x-ray workers.

It is well known that visible recurrences in the chest walls following operation may be entirely eradicated by irradiation. If this is true, why should not invisible cells which may be left by the surgeon respond to similar treatment? Also the amount of irradiation required to bring about this result, if properly applied, does not involve any great risk of tissue changes which may result in subsequent malignant degeneration.

Of course, postoperative irradiation must be applied skillfully to achieve results without harmful effects; and it must be accepted that the special knowledge necessary to carry out this procedure successfully is comparable to that of the surgeon who performs the operation.

Surgery, x-ray and radium are the only effective means available for the treatment of cancer of the rectum. Radical excision is

the preferable method of treatment in operable cases, but surgical intervention, to be effective, must be carried out early in rectal cancer. X-ray, radium and radon offer much encouragement from the occasional inoperable case in which microscopic and macroscopic changes occur in the treated tumor tissue whereby the case becomes operable. Almost all patients derive some benefit by way of lessened pain, bleeding and discharge.

A word regarding preoperative irradiation may be germane. Patients with carcinoma of the rectum are sometimes treated with x-ray or radium, sometimes both, and following an interval of one or two weeks are subjected to a posterior resection. Such a

procedure is decidedly hazardous because edema, bleeding and infection of the wound are increased. If preoperative irradiation is advised a sufficient time must elapse between irradiation and the operation for all reaction to subside. In our experience this interval varies widely but should never be less than three months.

In conclusion we feel that the management of carcinoma of the rectum is not a one man job. Surgery and radiology each have definite limitations and as we respect these limitations and learn to combine these two methods our results will improve. The full cooperation of all concerned is most essential.

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PHYSICAL THERAPY IN NASAL ACCESSORY SINUS DISEASE *

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The increasing interest manifested during the past few years in the study of sinus disease from both the medical and surgical aspects has been phenomenal. Until recent years, sinusitis was of little interest to anyone but the rhinolaryngologist, and he as a general rule, was more concerned with its local than with its systemic effects. We now know that it vitally concerns all who practice medicine, for infection from this source may involve any organ or tissue of the body, frequently giving little local evidence of its origin, and may escape detection for years because of its hidden nature. The proper treatment of sinus disease is an important problem which the medical profession has been forced to face, and one which must be met and solved in an adequate manner.

There is a definite need at the present time for a scientific evaluation of the various physical methods which have been employed in

the treatments of diseases of the eye, ear, nose, throat and the accessory sinuses. Numerous articles have appeared in recent years. Improved methods are being suggested, and good results are constantly being achieved with physical measures in a variety of eye, ear, nose, throat and accessory sinus conditions. However, in spite of this, the acceptance and general use of these measures as therapeutic aids has been slow, because of the lack of available, accurate scientific data, setting forth just what may be expected in a therapeutic way following their use.

Many of the newer books in otorhinolaryngology present the subject of the use of these physical measures in a vague manner, if at all. Frequently the fact is called to our attention that many of the investigations, which have been carried out along this line have been of a purely clinical nature, without the proper scientific background which is expected of organized medicine of today; the basis

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of our various methods of treatment being attributed with few exceptions to empiricism.⁽¹⁾

It is not within the province of this paper to enumerate all the diseases that may result from focal infection in the nasal sinuses, neither do I wish to present a series of rigid and highly technical methods for the treatment of these conditions. Rather, be it that the true purpose of this writing should be to stimulate renewed interest and investigation in the use of physical measures in the treatment of diseases of the eye, ear, nose, throat and sinuses; and to urge that accurate records of patients examined and treated be collected and preserved, in order that valuable scientific data may be available to determine either positively or negatively, the rational uses and true values of the employment of physical medicine in otolaryngology and the allied specialties.

In the interest of his patient, the progressive physician, be he general practitioner or specialist, owes it to himself to be familiar with, and possessed of sufficient knowledge of the various physical measures pertaining to his field, so that he may add them to his armamentarium and employ them adequately and efficiently in the treatment of disease.

The physician or surgeon should be equipped to use the methods best suited to the conditions at hand, and he should not be limited by lack of knowledge, ability, equipment or by prejudice. A thorough and detailed knowledge of the anatomy of the eye, ear, nose, throat and sinuses and a rigidly perfected technic are the essentials for success in this field.

Indications for Physical Methods

Although the various physical methods have been successfully employed for the relief of many diseased conditions of the upper respiratory tract, it must be borne in mind that each case must be individualized as to the appropriate and indicated methods to be used in the treatment of the condition. Marked emphasis should be placed on the necessity for complete findings in each case, together with a specialist's examination if deemed necessary, included in some cases, transillumination and x-ray findings, with reports covering examinations of blood and urine, also reports of smears and culture growths, to substantiate complex clinical findings and symptoms.⁽²⁾

After the completion of a carefully prepared case record, of all clinical findings, including subjective and objective symptoms, a prescription of the indicated physical measures to be used in the treatment of the case is outlined.

Almost every physical therapeutic measure has something to recommend its use in certain cases, while as in others, it may be ineffectual, contraindicated, and even decidedly harmful. It therefore behooves the physician to carefully discriminate as to these possibilities and determine the method of treatment which may be safely and effectually used to overcome the pathology. In the endeavor to find new methods for the treatment of the various diseases, it has become more and more evident that physical measures give positive benefit in acute, subacute and chronic conditions of the eyes, ears, throat, nasal tract and the accessory sinuses.

The following physical measures have been used with success in the diagnosis and treatment of upper respiratory tract pathology: transillumination, x-ray, radiant light and heat, infrared, diathermy, intranasal high frequency current, galvanism and the ultraviolet radiation.

To deal intelligently with any question pertaining to the sinuses, we must realize that they may be more or less involved in every disturbance affecting the nasal mucous membranes, and that every inflammation of the nasal mucosa probably extends to the mucosa of the sinuses.

It is beyond the scope of this paper to describe even briefly the various factors involving the etiology, symptomatology, pathology and diagnosis of the various diseases of the paranasal sinuses. Instead, I will discuss only very briefly those pertinent physical procedures that are of value in the diagnosis or treatment of the affections.

Transillumination — By transillumination, we can obtain some idea as to the size or extent of the sinuses, as well as some conception as to pathologic process that may be found within this area. The procedure consists of passing a strong light through the nasal cavity by means of an appropriate transilluminator. The frontal sinuses may be illuminated by placing the transilluminator into the superior internal aspect of the orbit well up against the frontal bone. The procedure must be carried out in a dark room. In health the sinus

will show an even red illumination. However, if the sinus is absent, or if it contains pus, or is lined by a pathologic membrane, the illumination will be absent or decreased, depending on the condition. The opposite sinus must always be illuminated and used as a basis of comparison. The maxillary sinuses may be transilluminated by placing the transilluminator within the mouth and closing the lips. Transillumination should be used only as any other laboratory aid, namely, as a means of confirming an established diagnosis.

Rotentgenograms — X-rays should also be used as an aid in establishing or confirming the diagnosis. Especially since the advent of radiopaque oils, we have a means at our command that may furnish us details as to the nature of the pathologic membrane lining the sinuses. By this means definite data may be obtained regarding the size, shape, and position of a sinus. The radiopaque oil may be introduced into the sinuses by means of a suitable trochar or the displacement method of Proetz.⁽³⁾

Acute Rhinosinusitis or Acute Sinusitis — This condition is characterized by acute inflammation of the mucous membranes of the nose with extension to the sinuses. The chilly sensation, nasal blockage and discharge, together with more or less severe headache, are the usual symptoms. The turbinates are swollen and edematous, and frequently a mucopurulent discharge is present. An x-ray taken at this time tends to show a slight haziness or even a distinct cloudiness of the paranasal sinuses. Physical therapy frequently offers much in the treatment of these cases.

Acute Sinusitis

Acute rhinosinusitis or acute sinusitis is often greatly benefitted by:

1. *Applications of luminous heat or infrared radiation to the entire face and head.* This tends to relieve the sense of fullness, congestion and pain, and promotes drainage. The time of exposure is from 20 to 30 minutes, sometimes longer, but never for a shorter duration. The treatment may be repeated at 2 to 3 hour intervals as necessary. Radiant heat is superior to other heat because its effects are more uniform.

2. *By Medical Diathermy* — Diathermy is a valuable adjuvant in the conservative treatment of sinus disease. This was confirmed by

Brooke,⁽⁴⁾ who found that the use of diathermy in sinus infection had shown a degree of recovery that frequently surpassed all expectation.

Hollender and Cottle⁽⁵⁾ in their survey of available treatment methods, with reference to physical therapy, showed that in both acute and chronic sinus disease, direct diathermy, properly applied, is the method which thus far has given the most satisfactory results and, therefore, is a decided advance in sinus therapy. Silvers⁽⁵⁾ states that he has cured many cases of chronic accessory sinus disease by this conservative treatment.

Medical diathermy produces an increase in temperature without destructive effect. It is applied to a sinus for its deep heating action, and because it is decongestive to the mucous lining involved, and probably to some extent absorptive. Analgesic properties as well as an ability to induce hyperemia and stimulate repair, also are noted.

Diathermy directly over the infected sinus is of decided value, but must always be used with caution. Some authorities feel that it is better to wait until the acute symptoms have somewhat subsided before diathermy is applied, and until such time, they have suggested the use of radiant heat or light.⁽⁷⁾ Diathermy, when properly administered in subacute sinus cases, often averts more radical interference.

Medical diathermy may be applied over the frontal or maxillary sinuses by making use of a plate electrode closely moulded to fit over the area to be treated, with a larger dispersive plate on the back of the neck of the patient. When treating the ethmoid and sphenoid sinuses, plates of equal size are placed on the sides of the face, the heat producing current is made to pass through the sinus being treated. Treatment is administered once or twice daily for a period of 20 to 30 minutes. Care must be exercised to regulate the strength of the current according to the tolerance of the patient, or in other words, the patient should experience only a pleasant sensation of heat.⁽⁸⁾

Under no circumstances should diathermy be applied to an acutely inflamed nasal accessory sinus, except in those cases where the sinus has been previously drained and ventilated by the usual methods of local intranasal medication, suction, irrigation, tampons, etc.

Adequate Drainage Is a Prerequisite — If

this important fact is disregarded, the heat tends to materially increase the pain of the inflamed sinus, and there may occur an exacerbation of all symptoms.

In selected cases, ultraviolet light may be applied intranasally for its lethal and stimulating action. Ellis and Wells state, that the lethal action is a direct one, of the rays on the bodies of the bacteria. It has been established that the bactericidal action of light is due to the rays of short wave length.⁽⁷⁾

Intranasal ultraviolet rays are administered by means of a nasal quartz rod attached to a water-cooled lamp. The applicator is at first inserted gently as far back into the nasal cavity as possible, then is withdrawn slowly to permit of fractional radiation to the entire mucosa, since all the effective rays are emitted at the tip of the applicator.

It is rather unreasonable to assume that the ultraviolet rays administered intranasally will penetrate the sinus and act directly on the diseased membranes. This does not occur unless the sinus mucosa is directly exposed by means of operative procedures, or unless the quartz applicator is inserted directly into the sinus cavity. The auxiliary use of ultraviolet rays within the nasal cavity aid in clearing up infections resulting from or accompanying sinus disease. The duration of the treatment, at first, is one minute to each nasal fossa, care being taken accurately to time the treatment thus avoiding blistering of the nasal mucosa. The treatment is increased one-half minute each treatment up to 8 to 10 minutes duration.⁽⁹⁾

The use of the new "cold quartz applicator" which has recently been introduced greatly facilitates this treatment. Since this applicator emits effective rays throughout its entire length, it thus materially reduces the time of treatment, about one-half.

Chronic Sinusitis

Certain selected cases of chronic sinusitis occasionally call for electrotherapy, before more radical surgical procedures are advised.

Medical diathermy frequently aids in the relief of pain in acute exacerbations. It is applied in the same manner as outlined under the treatment of acute sinusitis.

In cases with marked pathology within the sinuses, as for example, mucosal hypertrophies, and polyps, it is unreasonable to expect too much from this form of treatment with-

out surgical aid to favor *aeriation, drainage and antisepsis*.

Subacute and chronic sinus conditions may also be treated by ultraviolet radiation, or ultraviolet in combination with local heat, but again results tend to be disappointing when used independently of surgery.

Following surgery on any of the accessory sinuses of the nose, infrared radiation and medical diathermy are sometimes of value. Immediately after operation, if drainage has been provided, infrared therapy is effective in relieving pain and in promoting a free flow of secretions from the involved cavity.⁽¹¹⁾ After a few days have elapsed, diathermy applied directly to the diseased sinus aids in its resolution, or radiant heat and ultraviolet may be used as adjuncts.

Zinc Ionization

Zinc ionization has a limited use in promotion of the healing of the antrum, frontal and sphenoid sinuses, after they have been surgically drained by the proper operative procedures. In carrying out this treatment the procedure is as follows:

The head is so placed that the sinus to be treated can be filled with 0.1 per cent $ZnSO_4$ solution, into which a zinc wire is placed so that it is not in contact with the nose; this is connected with the positive pole of the galvanic apparatus. A dispersing electrode is placed on the back of the neck or arm, and 2 to 5 milliamperes of current passed for 10 to 15 minutes.

Ionization with either zinc or copper have proven efficacious in some of the exudative cases, either mucoid or purulent in nature. This method has been employed in the treatment of selected cases of chronic maxillary sinusitis. This method can be utilized satisfactorily only after large windows are made under the inferior turbinates, and such surgical intervention in itself fails to restore the sinus to a normal state.

Frequently after a maxillary sinus is punctured and washed out, the patient returns home, and a few hours later, often develops discomfort and pain over the sinus. In such a case, the application of the infrared lamp frequently relieves the pain completely.

Again the application of suction, like lavage of a sinus, gives rise to pain several hours later, and this type of pain can also be successfully treated by the application of the infrared lamp.⁽¹⁰⁾

Physical Status of Patient

In the treatment of acute rhinitis (the common cold,) which is the forerunner of many cases of acute and chronic sinusitis, let me stress the value of a thorough consideration of the general physical condition of the patient. Careful study has shown that acute rhinitis, with or without sinus infection, is frequently accompanied or preceded by a faulty metabolism, and imbalanced blood chemistry. In many instances, the "cold" is really a local manifestation of a physical defect, and in such cases local measures only serve to palliate, and general restorative agencies, directed against the general derangement, is the practical procedure to effect a cure.⁽¹²⁾ Of these, body ultraviolet irradiations should probably be considered first, and calcium, phosphorous, and vitamin deficiencies, secondly. These measures tend to normalize the blood stream, and are very useful, at times being of more benefit in overcoming the cold, than local therapy.

Conclusions

In conclusion, permit me again to stress (1) the necessity for early cooperative medical and surgical handling of all cases of sinusitis, (2) the need for adequate *aeriation, drainage and asepticization*, (3) the employment of the proper physical measures as adjuncts to hasten recovery.

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CHRONIC ARTHRITIS: RECENT PROBLEMS OF ITS STRUCTURAL CHANGES WITH SPECIAL REF- ERENCE TO PHYSICAL THERAPY *

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Chronic arthritis causes more prolonged disability, suffering and economic loss than any other chronic disease, not excepting tuberculosis. The medical profession is earnestly striving to solve the problem of its cause and to find its effective remedy. In recent years under the dominating influence of modern bacteriology the theory of focal infection has been propounded as a prime etiological factor. It is generally conceded that in both types of chronic arthritis, the rheumatic and the osteoarthritic, a low grade microbic infection is present. The consensus of opinion inclines towards considering chronic arthritis as a streptococcus infection, yet in spite of a huge amount of research work, up to the present time it has been impossible to find the specific microorganism. It has not yet been decided which strain of the streptococcus should be accepted as the causative microorganism. On the other hand, Crowe indicates as a frequent cause of arthritis a staphylococcus, the micrococcus deformans; Loewenstein and Reiter are in favor of the view that the bacillus of tuberculosis, while still other research workers believe that colon, dysentery, and pneumonia bacilli are the responsible factors.

It is a well known fact that most of the above mentioned bacteria can be always found in the nose, throat, mouth and bowels of normal persons. There are also many individuals who harbor dental, tonsillar, prostatic or other foci of infection for many years, yet do not show any signs of arthritis.

Considerations as mentioned above lead to the conclusion that there must be also some other factor responsible for the development of the disease. Bacteria take hold only in a medium in which they find an appropriate nutritive soil. Bacteria of the type held respon-

sible for arthritis will thrive only in a body with lowered resistance — with an arthritic diathesis, an increased susceptibility towards chronic infections. A lowered resistance as a rule depends on the constitutional make-up of the individual, introducing a consideration of the "constitution" as one of the main factors in the development of chronic arthritis.

Constitutional Factors

What do we mean by constitution? It signifies that complex of conditions which determines the reaction of the individual both against physiological (normal) and pathological (harmful) external and internal influences. The important function of the constitution is its ability to counteract any disturbances and to adapt the body to changed conditions. Two factors are recognized in the formation of an individual constitution: One of these is the genotypic factor — the qualities inherent in the germ plasm. In a large series of cases studied by Pemberton and Pierce⁽¹⁾ heredity played a very great rôle in the background of chronic arthritis. The other factor is the paratypic, i. e., the effect of environmental influences. Environmental forces constantly modify the individual constitution. Infectious diseases of childhood, unfavorable housing, lack of light, air and exercise, improper or insufficient food, all exert a potent influence on the constitution.

In recent years consistent efforts have been made to classify individuals according to constitutional types. Classification is based mainly on anthropologic measurements, and we accept that of Borchardt,⁽²⁾ differentiating between the asthenic or feeble and the pycnic or robust type of individual.

Studies by Osgood,⁽³⁾ Goldthwaite,⁽⁴⁾ Swaim⁽⁵⁾ brought out the significant fact that there is a close connection between these two types of body constitution and both forms of

* Read before the Eastern Section of the American Congress of Physical Therapy, Philadelphia, March 6, 1933.

chronic arthritis. Anthropometric measurements by one of us (J. K.) at the arthritis clinics of the Postgraduate and the St. Lukes' Hospital have further corroborated the fact that the infectious or rheumatoid type of arthritis appears mostly in individuals belonging to the asthenic type, while osteoarthritis is as a rule found in those of the pycnic type. We believe that the different forms of chronic arthritis can be explained on the basis of different body types.

Table I.

Constitutional Types in Arthritis

Asthenic Type

Long, narrow body.
Long neck.
Gracile bones.
Feeble — Inclined to ptosis.
Lack of fat.
Hyponotic.
Anemic.
Poor in connective and mesenchymal tissues.
Often hyperthyroid.
Lowered capacity for antibody formation.

Pycnic Type

Shorter, broad shouldered body.
Short neck.
Large bones.
Robust — Tendency towards obesity.
Fat retention.
Hypertonic.
Plethoric.
Abundance of connective tissues.
Often hypothyroid.
Increased response to stimulation.

When in the asthenic type resistance becomes lowered because of harmful external effects in the presence of an arthritic diathesis, a more active form of infection will appear — the rheumatoid type of arthritis, characterized by an exudative type of inflammation with proliferation of the synovial membrane and of the perichondrium. On the other hand, in the pycnic type an arthritic infection involves a slow degenerative process, and the affected joints present a picture of a dry osteoarthritis.

It is our belief that the two generally recognized types of chronic arthritis, the rheumatoid and the osteoarthritis, are brought about by identical etiological factors, and their different manifestations are based on the difference in body constitution. It must be recog-

nized, however, that we frequently meet with mixed body types, and generally we find the mixed form of arthritis in them.

A different body type in itself does not represent abnormality or increased susceptibility to different diseases, it takes harmful external effects to develop a morbid constitution, an arthritic diathesis. Diathesis ethnologically means disposition. It signifies an anomalous morbid constitution which no longer belongs within the confines of normal variability but represents a potential disease condition. From a clinical standpoint, the following factors have been shown to contribute to the development of an arthritic diathesis:

1. Previous disease of infections or inflammatory nature.
2. Unfavorable climate.
3. Damp dwellings.
4. Lack of sunlight.
5. Lack of exercise.
6. Bad posture.
7. Improper diet (lack of Vitamin B combined with carbohydrate excess) and overeating.
8. Dysfunction of the digestive system (constipation).
9. Disturbed function of the skin (instable thermo-regulating mechanism — reduced skin elimination).
10. Disturbed capillary blood circulation.
11. Dysfunction of the endocrine system (ovarian — thyroid glands).
12. Fatigue, worry, anxiety.

Constitutional Therapy in Arthritic Diathesis

The aim of a rational treatment of chronic arthritis is based primarily on the elimination or amelioration of the arthritic diathesis by means of a constitutional therapy and, secondarily, on the relief of the local changes. It is self-evident that regaining the full vitality of the body gives the best hope for the restoration of local pathological changes if not too far advanced, and it is also evident that different types of abnormal body constitutions will require a somewhat different type of constitutional therapy.

Careful regulation of the hygiene of daily life plays an important part in the constitutional therapy. Regular living habits, well planned exercises, proper posture for improving faulty body mechanics, suitable clothing

are essential parts of any plan. Regulation of the digestive function, especially the correction of any existing constipation, a suitable diet, adequate stimulation of the hormones, and, finally, an increase of circulation are important links of a constitutional therapy.

As to diet, a high vitamin and low carbohydrate content is indicated in both types of arthritic manifestations. Pemberton⁽¹⁾ believes that low caloric intake will benefit every type of case; we agree to this for the pycnic or robust type, but are of the opinion that in asthenic types, in people with anemia and a tendency to "emaciation," no restricted diet should ever be applied. A recent article by Snyder and Trager⁽⁶⁾ contains a wealth of useful information on this subject.

Remedial agents to increase the circulation are indicated in both types of arthritis. In the rheumatoid type the circulatory disturbance is due more to a spasm, a disturbed innervation of arterioles and capillaries, and treatment must be directed toward this spasm. Physical therapy measures are of foremost importance for this purpose, with histamin substances administered subcutaneously or through electrophoresis (ionization) being effective in some cases.

In osteoarthritis, where a phlethoric state and high blood pressure is generally present, to increase the blood circulation venesection is one of the most effective measures. Removal of 300 to 500 cc. of venous blood decreases the blood volume and viscosity and increases the speed of the circulation.⁽⁷⁾ Hess⁽⁸⁾ showed in dog experiments that in addition to the increase of blood circulation, the circulation of lymph also is increased. The amount of blood taken at a time depends on the blood pressure and on the amplitude of the pulse. It may be preferable as a rule to remove a smaller amount — 250 to 300 cc. at first and repeat the venesection three to four weeks later, taking a larger amount the second time. When osteoarthritis is connected with hypothyroidism, thyroid medication often brings prompt relief. In climacteric arthritis, ovarian preparations do not seem to show satisfactory results, while the removal of 200 to 300 cc. of blood often does.

We may sum up the principles of constitutional therapy in the two types of chronic arthritis as follows:

Table II

Constitutional Therapy in Chronic Arthritis
Rheumatoid Arthritis
(Asthenic Constitution)

Roborant and tonic therapy.
Normal caloric, low carbohydrate, rich vitamin and mineral diet.
Increase weight and fat deposits.
Stimulation of hematopoietic system, blood transfusion.
Stimulation of antibody formation, (vaccine, foreign protein, fever therapy).
Relieve increased capillary and arteriolar tone (physical therapy and histamin products).

Osteoarthritis
(Pycnic Constitution)

Eliminative and reducing therapy.
Low caloric, low carbohydrate, rich vitamin and low mineral diet.
Reduce weight and fat deposits.
Deplethorizing, blood letting.
Increase excretion and secretion through diuretics, cathartics, skin irritation.
Increase circulation and metabolism (physical therapy and thyroid medication).

Vaccine therapy has its legitimate place in the treatment of chronic arthritis. When a definite bacterial infection is found, vaccine therapy may be applied but it will influence only one factor; it leaves the arthritic disposition unchanged and the patient may get within a short time a new bacterial infection from the same type or another type of germ. In performing sensitization skin tests, it often happens that after two or three months of vaccine treatment a positive skin reaction occurs with a different type of organism. If a definite focus of infection can be proved, it should be removed, although spectacular and prompt results after such surgical intervention are the exception rather than the rule. We believe that a thoroughly administered constitutional therapy is essential for overcoming the original endogenic cause of the arthritic diathesis and that in many cases it will also eliminate the foci.

Physical Therapy

Physical therapy in chronic arthritis fulfills a twofold object. It serves as part of a constitutional therapy in increasing circulation and influencing metabolism, in promoting the activity of the digestive tract and in correcting faulty body mechanism. It relieves and prevents local arthritic changes, pain, stiffness, exudation, muscular contracture, atrophy and

weakness. Physical measures must be employed in every case according to a carefully individualized plan which takes into account the pathological changes present as well as the constitution and social conditions of the patient.

Physical therapy will afford maximum benefit if it is employed early in the disease and is properly coordinated with other constitutional measures, and is continued consistently for a sufficiently long period. There should be no polypragmacy, but rather a suitable alternation or combination of general and local measures. A certain change of methods is at times unavoidable in a definitely chronic condition like arthritis, hence the advantage of drawing on the large variety of circulatory stimulants offered by physical therapy.

Table III

Physical Therapy in Chronic Arthritis

1. *General or Systemic Measures*

1. Heat: Hot water baths, electric light baths, general diathermy, hyperpyrexia treatment. Galvanic baths with or without additional skin stimulation.
2. Heliotherapy, natural and artificial.
3. Exercise: Carefully supervised physical training and medical gymnastics.
4. General massage.
5. Colonic irrigations.

2. *Local Measures*

1. Heat: Luminous heat and infrared radiation. Diathermy. Hot air douche. Monoterminal high frequency (Oudin) current.
2. Galvanic current. Histamin iontophoresis.
3. Massage.
4. Voluntary and passive exercise.
5. Static wave current for decongestion.
6. Low tension wave currents for muscle exercise.

A. *Systemic or Constitutional Measures*

1. *Heat.* Age old empirical experience, extended clinical observations, Pemberton⁽⁹⁾ and recent physiological research, Bazett⁽¹⁰⁾ all point to the fact that thermal measures are potent agents in influencing circulation and metabolism. Changes in the body temperature following general heating result in the acceleration of the pulse rate, an increase of the circulation rate and a general vasodilatation in the skin. The circulating blood volume is increased, while the alveolar CO₂ tension and the alkalinity of the blood show a decrease. Respiration is affected at a rate of 5 to 6 respirations per minute per 1 degree C. (1.8

degree F.) rise in rectal temperature. Metabolism always shows a considerable increase on any increase of body temperature. These physiological effects may be varied in intensity and extent according to the nature, degree, duration, and interval of thermal treatments.

The clinical object of systemic heating therapy is amelioration of the arthritic diathesis by the stimulation of general circulation and the increase of body metabolism. The local changes are only indirectly affected, yet in many instances following general thermal treatment there is a decrease of pain and swelling and functional improvement in the affected parts. The selection of a systematic thermal measure must be made on the basis of clinical experience and within the limits of the expected individual tolerance. The patient's social circumstances and the question whether the measures are to be applied at the home, in the office, in an institution, or a health resort also enter into consideration.

The *hot water bath* is perhaps the simplest and generally available thermal measure. It may be started at a temperature of from 96 degrees to 99 degrees and gradually carried to 102 degrees, employed from five minutes to half an hour, two or three times a week. It should never exhaust a patient. Fragrant pine extracts or other resinous substances, or vile smelling sulphur mixtures are often recommended as an addition to these hot baths, with all kinds of extravagant claims; the only effect of these substances is an additional mild stimulation of the skin, especially when gentle friction is employed with the bath. A galvanic current passed through a warm bath exerts a marked stimulating effect but no specific curative virtues, contrary to the claims of commercial promoters of these "electric" baths. Prolonged hot baths or hyperpyrexia baths are very exhausting and must be employed only with due care in selected cases with a robust constitution. The same precaution relates to an additional application of a cold or an alternating hot and cold water application, known as Scotch douche. In suitable cases it adds to the general stimulating effect by neuromuscular "toning." The same effects can be adapted to home use by means of a cool bed sponge.

Electric light cabinet baths, steam and hot air baths are being employed in the institutional treatment of chronic arthritis of the

robust. General light baths from high wattage (1500 or more watts) incandescent lamps, applied for half an hour or more may be conveniently administered in physicians' offices instead of the somewhat more exhausting cabinet baths. General diathermy, or in occasional instances, autocondensation are suitable for general thermal effects in office practice.

High frequency fever treatment through a powerful diathermy apparatus or through a short wave apparatus (radiotherapy) offers a new but not yet fully evaluated institutional means for profound constitutional effects. Carpenter and Warren⁽¹¹⁾ report some striking results in infectious types of arthritis. In a limited series of cases of ours under treatment the failures and the encouraging results were about equally divided but good results were particularly evident in chronic gonorrheal arthritis. None of the general heating measures should ever be instituted in a haphazard way and without definite indications. Provision must be made for patients to cool off and rest after any general heat treatment. A well planned course of general thermal measures should be followed by a period of no treatment or be alternated with suitable local therapy. It is not advisable to employ vaccine therapy during a course of general heat-treatment.

2. *Heliotherapy — natural and artificial.* Benefits reported in non-tuberculous chronic arthritis after sojourns in heliotherapy resorts, or after artificial radiation, are explained in part by the general tonic effects of irradiation, especially on patients with an asthenic constitution and rheumatoid arthritis; in addition, recent research work shows that chemical, thermal and other "insults" of the skin provoke or increase the defensive power of the body by a direct effect on immunity and by the stimulation of the immunizing mechanism through the absorption of the products of the tissue damage. Colebrook, Eidinow and Hill⁽¹²⁾.

3. *Exercise.* General exercise in the form of physical training or suitable athletic sports is of considerable importance in the harmonious upkeep of the vital forces of the body and in counteracting a general body inactivity towards which so many arthritics incline. Medical gymnastics or postural exercises are indispensable for correcting faulty body mechanics, malposture, ptosis, imperfect action of the

diaphragm, etc. To carry out these measures in actual practice requires familiarity with the subject of exercise and a definite knowledge of basic orthopedic principles.

Exercise of the abdominal muscles by voluntary work or by low tension wave currents (the surging faradic or interrupted sinusoidal) has as its object the improvement of tone of the musculature, the stimulation of peristalsis, the aiding of the venous return from the abdomen to the heart, and the stimulation of glandular function. This is expected to result in the general improvement of circulation, digestion and elimination and to bring about a better functional efficiency of the entire body.

4. *Massage.* General body massage, preceded, as a rule, by a general thermal measure, is of recognized value for overcoming the feeling of fatigue, building up the muscular system, stimulating body metabolism, and soothing the nervous system. In many of the health resorts the combination of general heating and massage with hydrotherapeutic procedures, such as the Aix-le-Bain douche, is found beneficial in properly selected cases. Massage, local as well as general, must begin in the form of gentle stroking over a limited area and be increased in extent and force only as the patient becomes accustomed to the procedure.

5. *Colonic Irrigation.* Colonic irrigations, like various other physical methods, have been popularized in recent years by commercial methods rather than by sound clinical considerations. As many physicians consider the intestinal tract as a major secondary focus of infection, it appears desirable that the bowels be kept open adequately without irritation. Whether colonic irrigations are necessary for this purpose or not depends on the circumstances of the individual case and the clinical experience of the attending physician.

Local Physical Measures

1. *Heat.* Local heat treatment has for its object the increase of local blood and lymph circulation and local tissue metabolism, promotion of resorption and restoration of function. An even more important effect of suitable local thermal application is relief of pain, the symptom most bothersome and depressing, next to the stiffness and limitation of motion.

Numerous measures are available for local heating. Hot wet compresses, hot poultices,

electric heating pads are popular as pain relieving measures. For simple yet efficient routine heat application in the home and in the office, infrared and luminous heat generators mounted on suitable stands are now generally preferred, and have largely replaced the old cumbersome dry baking apparatus and light boxes. The penetrating effect of the luminous heat is somewhat deeper than that of infrared generators. For home treatment patients should be instructed to use these appliances over the affected joints for half an hour two or three times a day. Well planned home treatments help to keep patients comfortable and allow the bridging of the time between office visits.

Diathermy has become recognized in recent years, as the most efficient form of deep heating. Recent research work by Edstrom⁽¹³⁾ has proven beyond doubt that the interior of joints can be effectively heated.

Extended clinical experience has shown that diathermy will do more for local relief of pain, promotion of resorption, and restoration of function than any other physical measure; it also lends itself easily to a combination with other local and general measures. Best results can be expected in cases of osteoarthritis localized in one or two of the larger joints or in the spine.⁽¹⁴⁾ In the frequent, bilateral knee involvement of the osteoarthritic type diathermy is well-nigh specific in its local sedative and restorative effect.

The monoterminial high frequency current (known as the Oudin current) has a well defined use for mild counterirritation in fairly subacute arthritis involving several joints and should be employed following external heat treatment. In painful involvement of small finger joints the hot air douche, produced by an ordinary hot air drier, affords usually a marked analgesic effect.

2. *The galvanic current* is indicated in cases of atrophic arthritis of long standing where fibrous tissue changes have taken place. It is important that as large amount of current as can be borne be applied for a sufficiently long time. When there appears a combination of chronic arthritis and neuritic pain in the same extremity the local galvanic bath may be beneficial. Recent favorable reports on the effects of histamin ionization have been partly corroborated here.

3. *Massage and exercise* belong among the mechanical measures which are indispensable

in almost every case of chronic arthritis, the others being active and passive exercise, low tension wave currents, and the static wave current. The common object of all these measures are the maintenance and improvement of circulation and drainage in and around the affected joint, and the correction of the atrophy of the soft structures, especially those of the muscles.

Massage is the most readily available mechanical measure in arthritis. It must be applied in the most gentle and careful manner, for its incorrect or over-zealous employment adds insult to injury by traumatizing the joints. Only gentle stroking with some light kneading should be performed, and this is better done in the neighborhood of the diseased joints rather than immediately over them. When the help of a skilled technician is not available, physicians should give suitable instruction to family members of patients confined to the home, assuring the patient at least some massage with a measure of success.

In arthritis of the rheumatoid type motion must be insisted on if fibrous and later bony ankylosis is to be prevented, and the safest way of carrying this out is to have the patient do *active* exercises within the fullest possible range of motion after the parts have been prepared by heat and massage. The passive movement of joints in conjunction with massage requires great caution; in many instances forced passive movements, twisting and bending tend to traumatize the tender joints. Patients must receive individualized instruction as to what exercises they can do at home and the range of motion they should attempt to attain.

The application of any mechanical measure should always be preceded by heat, external or deep, for it opens up vascular channels, relaxes the parts and enlarges the range of motion. Experience in therapeutic pools has shown that joints in the stage of subacute arthritis can be carried painlessly through a surprisingly large degree of motion.

4. *The static wave current* offers unexcelled benefit through gentle, pleasant molecular massage with a decongestive effect, which is well recognized by those who have had experience with it. Wherever there is edema and marked stasis, the static wave current will reduce it evenly and with less effort and trauma than hand massage. Static sparks applied around tense and spastic joints aid their mo-

bilization, arthritis patients usually feeling markedly limbered up after a series of well placed sparks.

5. *Low tension wave currents*, such as the surging faradic, the slow or interrupted sinusoidal, maintain the tone of muscles and prevent atrophies in the later stages of chronic arthritis.⁽¹⁵⁾ The combination of voluntary exercise with electrical muscle stimulation tends to prevent one of the most frequent causes of increasing disability in arthritics — muscular atrophy.

Conclusions

1. Chronic arthritis is a systemic disease with local manifestations in the joints. The different forms of arthritis are in close connection with the different constitutional body types. The combating of the disease is planned primarily through systemic measures to which local measures are added in accordance with the prevailing signs and symptoms.

2. Constitutional therapy is directed towards the elimination of the arthritic diathesis, and towards the restoration of the full body vitality. It should be planned and carried out according to the different constitutional types.

3. Physical measures are an invaluable aid in constitutional therapy and are the mainstay of the local therapy. They must be employed consistently according to a definite plan, and this should provide for a suitable alternation of systemic and local measures. Polypragmacy is to be avoided but a certain change of methods is desirable in a definitely chronic condition. In certain types of cases provision should be made to carry out simple routine measures in the home.

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A PLAN FOR A REGISTRY OF PHYSICAL THERAPY TECHNICIANS

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The desirability of closer unity between physicians and physical therapy technicians calls for plans which should insure better understanding and closer cooperation of both groups. The time is propitious for frank discussions.

Among the practical suggestions advanced by the Council on Physical Therapy of the American Medical Association one is especially applicable to our problems. The Council advocates the encouragement in the training of technicians because of the invaluable aid they may offer to the physician practicing this specialty (physical therapy). The Council also expressed unequivocal opposition to the independent practice of technicians, by stating: "Technicians should be discouraged from establishing individual plants, even though the major part of their work is referred by physicians."

It is gratifying to state that this recommendation received the hearty approval and support of the American Physiotherapy Association, an organization created by prominent war-time Reconstruction Aides. The stand taken by that organization justifies a brief review of its history and aims.

At the time the United States entered the war there were in the service no women trained in physical therapy, and no nurses could be spared to receive special training. Through the aid of Colonel Joel E. Goldthwait and Colonel E. G. Brackett, the services of several qualified women were secured, among them being Marguerite Sanderson from Dr. Goldthwait's office, and Mary McMillan, an English physiotherapist. On December 31, 1917, the organization known as the Reconstruction Aides originated in the office of the Surgeon General, under the direction of the Division of Orthopedic Surgery.

On April 1, 1918, the organization was transferred to the Division of Physical Reconstruction. Dr. Frank B. Granger was placed in charge of all matters relating to Reconstruction Aides in physical therapy.

The first course for the training of Aides

was organized at Walter Reed Hospital in Washington. Fourteen schools and colleges organized courses to meet uniform requirements outlined by the Surgeon General's office. The first course to meet the above requirements was at Teachers College, Columbia University, New York City, under the supervision of Miss Lillian C. Drew. The largest training center was at Reed College, Eugene, Oregon, under the supervision of Mary McMillan.

Early in 1920, a committee at Walter Reed Hospital organized the American Women's Physical Therapeutic Association, with Miss Mary McMillan as President, and Miss Janet B. Merrill of Children's Hospital, Boston, as secretary. On January 15, 1921, a meeting was held in New York City to discuss the question of forming a national physiotherapy association, with all the local branches under one constitution and with national officers. At this meeting there were present Lieutenant-Colonel Frank B. Granger, Major William McFee of Boston, Lieutenant-Colonel H. D. Corbusier of Plainfield, New Jersey, Major Ney of New York, Major Sampson of Fox Hills, and Commander Bainbridge of the Brooklyn Naval Hospital, as well as thirty Aides. The organization took the name of the American Women's Physical Therapeutic Association, which name it kept until March, 1922, when it was decided that men holding the same qualifications should be eligible. The name was then changed to the American Physiotherapy Association.

The constitution of the American Physiotherapy Association states:

"The standards of ethics for this Association shall be as far as possible those of the American Medical Association. All members shall practice only under the prescription and direction of a licensed physician."

American Registry of Physical Therapy Technicians

With the increasing use of physical therapy by the medical profession it has become a vitally important question for the physicians to

have well trained technicians available. Since physical therapy is a definite part of medicine the training and qualifications of these technicians should be judged by the medical profession. Therefore the three associations of physicians that employ these technicians more than other groups have been requested to assist in the formation of a registry for physical therapy technicians. A suggested plan for this registry is offered below, and any comments related to it will be appreciated.

Name. The Registry shall be known as the American Registry of Physical Therapy Technicians, and it shall be directed by a Board composed of five members.

Objects. The objects of the Registry are:

1. To maintain the minimum standards of educational and technical qualifications as given by the Council of Medical Education of the American Medical Association for technicians administering physical therapy in hospitals, clinics and doctor's offices.

2. To receive applications for and issue certificates of registration to those who meet the educational and technical qualifications as given under "Eligibility for Certification."

3. To cooperate with the Council on Medical Education of the American Medical Association in their investigation, classification, and periodical inspection of schools which conduct training courses for physical therapy technicians.

4. To conduct a placement bureau for registered physical therapy technicians and assistants.

5. To promote the use of these registered technicians and assistants in hospitals and doctor's office by various articles and advertisements in medical publications.

6. To cultivate high ethical standards among the technicians.

Board. 1. The Board of Registry shall be composed of five members; one each from the American Orthopedic Society and the American Academy of Orthopedic Surgery, two from the American Congress of Physical Therapy, and one from the American Physiotherapy Association.

2. The Board shall elect its officers, and employ a Registrar. The registrar shall conduct the office of the Registry and attend to the routine business transactions under the direction of the Board.

3. Duties of the Board:

- a. The Board shall pass on the acceptability of applications for registration.

- b. It shall arrange for the necessary examinations.

- c. Every member of the Board will review and vote on applications for registered physical therapy technicians.

- d. It shall issue yearly a full list of registrants classified alphabetically and geographically.

Applications for Registration. Upon request, the Registrar will furnish blanks on which formal applications are made for certification, with data to be filled in giving information as to the applicant's preliminary education, technical education, experience in physical therapy, and training and experience in other fields; also references from two licensed physicians.

Eligibility for Certification. There will be two classes of certification:

A. Physical Therapy Technician.

1. Applicants who were graduated from an approved school of Physical Therapy, by which is meant a school which gives not less than three years training in physical therapy, and is approved by the American Medical Association.

2. An approved course in Physical Therapy, by which is meant a course of not less than nine months, approved by the American Medical Association thereafter, following graduation from a School of Nursing or Physical Education which meets the requirements set by law in the individual state, or having sixty university credit hours including twenty-six hours of the following subjects:

Physics, chemistry, zoology, biology.

3. Applicants with qualifications equivalent to the above, who have been accepted for membership in the American Physiotherapy Association prior to the establishment of this Registry.

4. Applicants with qualifications which the board of registry shall deem equivalent to (1) and (2) and who have satisfactorily passed an examination conducted by this Board.

B. Physical Therapy Assistant.

1. Applicants who have completed high school education, or its equivalent, and have had five years of experience in Physical Therapy under the supervision of a licensed physician.

2. Applicants who have one of the following qualifications:

a. Graduation from a school of nursing or physical education which meets the requirements set by law in the individual state, and in addition have had, not less than one year of experience in Physical Therapy, under a licensed physician.

b. Completion of sixty university credit hours including twenty-six hours of physics, chemistry, zoology, biology, and in addition have had not less than one year of experience in Physical Therapy under a licensed physician.

Registration of Technicians and Assistants. Candidates shall fill out the formal application blanks of the Registry and file them with the Registrar.

Upon receipt of an application, the Registrar shall conduct a preliminary investigation of the applicant and the result shall be filed with the application.

If the applicant is eligible under (1), (2), and (3) for registration as a physical therapy technician, her application and the Registrar's investigation must be reviewed by each member of the Board.

If an examination is necessary, the examination questions are prepared by the Board and forwarded to a designated physician who practices in the locality in which the applicant resides.

The Registrar and one member of the Board may approve applications for registration as physical therapy assistants.

The fee for registration is ten dollars and is not returnable in case of failure. The applicant may, after the lapse of six months, be

122 S. Michigan Avenue.

given the privilege of another examination without additional charge.

A certificate designating the classification of registration will be issued to all applicants accepted by the Registry. This certificate shall be good only to the end of the calendar year in which it is issued. A renewal fee of \$1.00 will be charged for each calendar year.

A certificate may be revoked at any time for cause at the discretion of the Board. A hearing shall be granted upon request.

Title of Registrant. The certificates issued by this Board designating the holder as "Physical Therapy Technician" signifies a person who is qualified to administer all forms of physical therapy on the prescription of a qualified physician and who has fully met the maximum educational requirements and whose application has been reviewed by every member of the Board.

Holders of this certificate may use the letters R. P. T. (Registered Physiotherapy Technician) after their name.

The certificates issued by this Board designating the holder as "Physical Therapy Assistant" signifies a person who is qualified to assist a physician in administering physical therapy, and who has met the minimum educational requirements and duly passed the examination as herein provided.

Code of Ethics. All registered technicians and assistants shall be required to strictly observe the Code of Ethics as defined by the American Congress of Physical Therapy, namely that they shall practice only under the prescription and direction of a licensed physician and shall under no circumstances on their own initiative treat patients or operate an office independently without the supervision of a qualified physician.



EMANOTHERAPY BY THE VAUGEOIS PROCESS *

L. GODIN

Preparator in the Physico-Biologic Laboratory of Prof. d'Arsonval
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The difficulties encountered in the extraction of radon (radium emanation) as well as the impossibility of finding an apparatus lending itself to ease of manipulation, requiring no special experience on the part of practitioners, are the principal reasons which prevented extensive utilization of the remarkable energy of radioactivity, in spite of the splendid clinical results obtained with it.

On June 13, 1932, Prof. d'Arsonval presented to the Academy of Sciences of Paris the importance of research undertaken by his former collaborator Georges Vaugeois with reference to filling that want. This research, which was continued after Vaugeois' death by his successor, resulted in the realization of a solid emanogenous source, which is not only transportable but applicable without preliminary manipulation.

What is more, the easy adaptation of this solid source of a number of appliances renders possible the internal administration of diverse radioactive emanations — by ingestion, inhalation, pulverization, baths, internal irrigations, hypodermic injections, intraorganic insufflations, and so on.

It should be also noted that the Vaugeois processes present the important advantage of bringing in contact with the tissues pure emanation, devoid of the generating salt. In this way the Vaugeois processes place emanotherapy on a practical basis, free from every risk.

Apparatus

The appliances for the application of the Vaugeois processes consist of:

1. Apparatus for the generation of radon or thoron.
2. Apparatus, called "for utilization," facilitating the charging of liquids, and solids, with an emanation of gases according to their therapeutic application.

Generators of Radon. These generators are now available for practice in the shape of metallic tubes, closed by one or two stopcocks, holding the radiferous material productive of

radon. Liberation of radon is effected incessantly and constantly in a manner that after each twenty-four hours duration the closed tube has accumulated in its interior a sufficient quantity for one application. This twenty-four hour accumulation varies between 700 to 10,000 millimicrocuries according to the design of the generator. Each generating tube, therefore, makes possible the treatment of one patient per day. However, the frequency of the séances depends on the particular sensitivity of the patient to the radiations as well as on the nature and stage of the affection. It is easy to vary the dose of radon for application by increasing or shortening the period of accumulation.

Generators of Thoron. The speediness of disintegration of thoron does not permit this form of emanation to be accumulated like radon. The generating tubes have therefore no stopcocks, the quantity of thoron to be utilized depending on the duration of the passage of the gas vector across the generator. This gas vector will be provided by a constant and regular delivery. Knowing the liberation of thoron per unit of time, one will very rapidly determine by simple multiplication the quantity of thoron induced by the gas vector in a given time ("t"). The minute activity of these generators oscillates between 50 and 200 millimicrocuries. The irradiation can be reduced or increased at will by diminishing or by increasing, as needed, the duration of the passage of the gas vector.

Description of the Apparatus "of Utilization"

The yield of these instruments of emanation for introduction into the organism is obtained in a very simple manner — either by vacuum or by pressure exerted on the gas. No complicated manipulation is needed for the operation. What is more, it is accomplished for the application of radon by a simple manipulation of the stopcock.

Hypodermic Injection or Intraorganic Insufflation. The generator or radon or of thoron is interposed between the compressor and

* (Translated by an Associate Editor.)

the needle for injection, which latter is replaced by a cannula of a sound for rectal, vesical, or pleural insufflations. The compressor may be an oxygen tank, a syringe of 50 to 250 cubic centimeter capacity, a Richardson double bulb insufflator, etc. The quantity of the gas vector to be injected varies between 90 and 250 cubic centimeters, the duration of the application itself varying from three to five minutes.

The therapeutic indications are:

For Radon or Thoron: Rheumatism, Gout, Arthritides, Dermatoses.

For Radon: All algias, neuritides, infections.

For Thoron: Anemias, Leukemias.

When it is necessary to introduce the gas vector under a very weak pressure (Stomatology, Otology and Rhinology, Ophthalmology) one has recourse to a special syringe made for this purpose. This syringe, after sterilization, is attached to the emanogenous chamber. The aspiration produced by the play of the piston causes the radon accumulated in the chamber to pass into the syringe. The generating chamber is then detached from the syringe and replaced by the injecting needle. This technic is employed when treatment is to be given with a feeble pressure of the activated gas to easily accessible nerves (neuritides), for muscular spasms, or contractures.

The therapeutic indications are:

In Stomatology — Alveolo-dental pyorrhea, neuralgias, fistulae, abscesses.

In Otology — Eczema and dermatoses of the auricle and of the ear canal, fistulae.

In Rhinology — Folliculitis of the nares, dermatoses, chronic rhinitis, ozena, atony of the mucosa, reflex asthma of nasal origin.

In Ophthalmology — Nystagmus, iritis, glaucoma, sympathetic ophthalmia, lesions of the optic nerve, intra-ocular neuritides, retrobulbar pain, and certain forms of conjunctivitis.

Inhalations. 1. The arrangement for radioactive inhalations requires the employment of gas under pressure (oxygen, carbonic acid, etc.) provided either by an air compressor or by cylinder of compressed oxygen provided with an appliance capable of collecting 1 or 3 Kilograms, the strong pressure taking place in the interior of the cylinder. It is under this reduced pressure that the oxygen is carried into a reservoir after having passed an

interposed generating tube of radon, from which it carries off the emanation accumulated in its interior. This gas radioactivated under feeble pressure is subsequently transmitted to an ordinary inhalator by a rubber carrier especially manufactured for such purpose. The radioactive gas is liberated by being stirred in the warm liquid contained in the bowl of the inhalator. The gas may be inhaled either pure or mixed with any desired medicated vapor.

A generating tube of thoron wedged in between the reservoir and the inhalator enables the administration of both emanations.

2. Another arrangement is available for the treatment of patients at their homes or when a gas vector under pressure can not be obtained. It consists essentially of a Richardson double bulb attached to a generating tube of radon, which in turn is connected with a gas bag enclosed in a wooden box. The air produced by the Richardson double bulb carries into the gas bag the radon accumulated in the interior of the generating tube.

Suitable pressure exerted on the gas bag forces the radioactivated air and enables it to become liberated by stirring in the liquid in the bowl of the inhalator. To this liquid one may add antiseptics or balsamics, the vapors of which will also be activated.

The therapeutic indications are: Anginas, tonsillitis, coryza, ozena, pneumonia, laryngeal tuberculosis, pleurisy, asthma, emphysema, intoxication by war gases, and generally whenever emanotherapy is indicated.

3. Radioactive inhalation can also be attained by a face mask connected by a screw fastener to a generating chamber of thoron. This generating chamber of radioactive emanations is equipped with valves which open on inspiration in a manner that the atmospheric air or every other gas is drawn by the pulmonary inspiration across the generator of the emanation, becomes charged with it during the passage, and reaches the lungs in activated form, while the expired air is expelled with each expiration by a valve, which during inspiration closes an aperture in the side of the mask. This appliance renders easy the treatment with radioactive inhalations which can be employed at all times and everywhere.

Therapeutic Indications: Acute and chronic coryza, sinusitis, chronic rhinitis, ozena, rhino-tracheo-bronchial catarrh, pharyngitis, laryngitis, chronic bronchitis, laryngeal tuber-

culosis, pleurisy, asthma, emphysema, war gas intoxication, anemia, and generally whenever emanotherapy is indicated.

Pulverizations. 1. By Activation of the Gas Vector. The arrangement for radioactive pulverization consists of the same apparatus as that for inhalation, except that the inhalator is replaced by a powder insufflator or atomizer containing a liquid which also becomes activated and thrown off as fine particles, which in turn carry the gaseous emanation held in suspension.

Therapeutic Indications:

In Rhinology — Cleansing of the cavity, pharyngitis, sinusitis, rhinitis, etc.

In Surgery — Indolent wounds, infected wounds, sinuses.

In Gynecology — Pruritis vulvae, reduction of the turgescence of the mucous membrane in vulvitis, vaginitis and vaginismus, metritis with endo- and exocervicitis, infected lesions, etc.

2. By Activation of Liquid. The apparatus for the pulverization of liquids consists of a generator of radon in a permanent charge over the container holding the liquid to be activated. The connecting handle, whose interior is hollow, receives a generating chamber of thoron whose hyperglobulizing action is added to that of the radon. This kind of appliance is equipped with an atomizer which projects as fine pulverizations the radionized liquid in connection with the air charged with thoron. This apparatus, being constantly charged, is always ready for use.

Therapeutic indications are: Diverse wounds, affections of cavities (vagina, nose, throat), tonicity of the skin, oils for massage, etc. In connection with all physical agents, as ultraviolet, irradiations, etc., it is indicated in adenitis, scrofula, etc.

Balneation. The apparatus "Activeur-Mélangeur" (Activating Mixer) facilitates the practical use of baths with water charged with dissolved radon. It consists essentially of a vessel which is filled with cold water. The tube generating radon is affixed to an upper tubular arrangement opposite the funnel, the emanation being introduced by means of an air vacuum equivalent to that of the water, which is no less than the capacity of the interior of the emanogenous tube.

The radon becomes mixed with the cold water of the vessel by the energetic power obtained from a centrifuge pump driven by an

electric motor. The radioactivated water is finally led by rubber tubing either to the depth of the bath tub or to a special storage bottle for future use.

Therapeutic Indications — Phlebitis, varices, dermatoses, psoriasis, pruriginous erythema, gout, arthritism, tonicity of the skin.

Carbon-Radioactive Gas Baths (radon and thoron) are indicated in diseases of the arteries, atheroma, compensated cardiopathies, cardiac weakness.

Vaginal Irrigations. The various appliances for the radioactivation of vaginal douches have been grouped as a "standard," in connection with a container of 50 liters capacity, in which are united cold and hot water obtained from special faucets. The complete outfit circulates by special appliances producing a current of warm water proceeding from the container and passing over a sliding device which enables gradation of the pressure of the utilized water. This current or circuit of warm water receives at a fixed point a gas under pressure (oxygen, air, etc.), activated by the radon, provided by the reservoir on the right. This gas has previously been enriched by thoron through its passage across the tube generating this emanation, which tube is fastened at the upper part of the board. The flow of warm water carries the activated gas from then on towards the appliance of utilization after having come in contact with a thermometer. A U-shaped glass tube renders visible the passage of the radioactivated gas bubbles suspended in the liquid.

Therapeutic indications are: Vulvo-vaginitis, metritis, metro-salpingitis, metrorrhagia, dysmenorrhea, amenorrhea, pelvic neuralgia, pruritus vulvae, vaginismus, difficult ovulation, sterility.

Ingestion. The apparatus utilized for the ingestion of radioactive liquid or solid substances consists of:

(a) A generating tube of radon closed by a stopcock.

(b) A carrier provided below with a rubber stopper and above with a place for the insertion of the generating tube. The easy adjustment of the generating tube to all sorts of receptacles as well as to special cases renders possible:

1. To activate, apart from watery drinks, all liquid medicines and foodstuffs (e. g., milk,

cod liver oil, mineral oil, syrups, tonic wines, etc.).

2. To overactivate or to reactivate mineral waters, whose activity has been lost through lapse of time or attenuation.

3. To activate even solids which are good absorbents of radon, e. g., charcoal powder, ointments, etc.

The solution of radon thus obtained is entirely free of even a trace of radium, the accumulation of which in the human organism may occasion grave consequences.

Therapeutic indications are:

1. Drinks — Arthritism, gout, gravel, diabetes, migraine, lithiasis, dermatoses, neurasthenia, endocrine disturbances.

2. Radioactivated Cod Liver Oil — Adenopathy, lymphatismus, scrofula, dermatoses.

3. Medicated Syrups, Tonic Wines — Special indications.

4. Activated Mineral Oil — Intestinal atony.

5. Radioactivated Olive Oil — Massage for painful joints.

6. Radioactivated Hair Lotions — Seborrhea.

7. Activated Carbon Powder — Same indications as for radon solution, and especially for intestinal fermentation, diarrheas, flatulence, etc.

8. Activated Ointments — Dermatoses, acne, seborrhea, etc.

Bandaging. Wrappings are applicable to the extremities. Each of the appliances consists of special tissue sheaths, carries two rubber tubings, the upper part of which is fixed to the pneumatic pad which assures by inflation water-tightness of the bag, while the lower serves for the introduction of the emanation.

The generating tube being interposed between the bag, and a series of insufflations sweep the emanations accumulated in the interior of the tube and carry it into the bag surrounding the affected extremity.

Therapeutic indications are: All algias localized in an extremity, postphlebitic and post-traumatic edema, trophic cutaneous disturbances, articular stiffness.

Rectal Drop by Drop Administration. This apparatus is equipped with two stopping devices (A and B) between which is interposed a visible emanogenic chamber containing the generating salt of radon. The radon accumulates in this cavity, closed by the two prick-

punch stopcocks, which should be kept closed at least 24 hours before using the apparatus. One will then have the quantity of radon needed for one application, but an accumulation of a much longer period will not cause any caustic or toxic phenomena.

One may, if desired, utilize feebler, nay even homeopathic, doses by leaving closed the stopcocks for only a few hours before application, the quantity of radon being mechanically carried by the falling of each drop of liquid, while the partly dissolved radon in this liquid can be reduced according to the desire of the practitioner.

Therapeutic indications are, hemorrhages and severe anemias due to loss of blood and tension, surgical shock, septicemia, gastric and duodenal ulcer, trauma or wounds of the abdominal viscera, nervous instability.

Conclusions

The procedures of Vaugeois, which are an innovation, are essentially characterized by:

1. Emanogenous tubes constituting a permanent source of radioactive emanations, easily manipulated, economic, and always at the disposal of the physician.

2. Easy adaptation of these emanogenous tubes to an entire group of appliances, capable of producing the irradiation needed for the treatment of a given affection.

3. Employment of energetic medication, the extent of which between a therapeutic and a toxic dose is so large as to insure a virtually absolute harmlessness.

4. A multiplicity of methods of introduction permitting general treatment to modify diatheses, to enhance adjuvant treatment, especially indicated in local disturbances.

5. Possibility of fixing in the organism a well determined radioactive effect at the will of the physician, facilitating treatment according to the individual sensitivity of patients.

6. A means accorded each patient to follow a course of radioactive treatment in his home, according to the exigencies of his health and not limited to the open seasons of balneologic institutions.

Finally the Vaugeois procedures provide a medication, which if it is several times thousand fold in its essence — which insures its efficacy — is in some way replaced by modalities of applications of a scientific technic which multiplies the means of effect.

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

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E D I T O R I A L S

REGISTRY OF TECHNICIANS — A PRESSING PROBLEM

Ever since physical medicine has been developed to a state when its therapeutic value is generally recognized, various groups have contested for its utilization in the treatment of the sick. Opposed to the regular profession endeavoring to uphold a scientific stratum of every physical agency in a biologic fundament, there exists a host of pretenders, charlatans and pseudo-physicians exploiting the hard won popularity of physical therapy in a fashion less than empiric and for purposes purely ulterior. Considering that physical therapy is an integral part of scientific medicine, such a sad state of affairs is explainable only by our faulty and inadequate legislation, which has opened an unguarded door to the field of drugless healers and their ilk.

At this time we have another group which in reality should be a valuable force, allied with the regular profession — the physiotherapy technicians and aides. Undoubtedly this body can and should represent a force for good, if it insists in upholding the ideals and ethical traditions of scientific medicine. It hardly needs stressing that for the attainment of such a desirable objective there must be not only cordial cooperation between the

legitimate physician and the ethical technician or aide but also avoidance of anything apt to resemble an alliance with the group of borderline practitioners.

Up to now no systematic attempt to codify the inter-relation between the two legitimate groups concerned has been made. In the absence of a code an opportunity presented itself to a certain type of poorly trained technicians to commercialize their limited qualifications in direct competition with the orthodox practice of medicine. Unfortunately such a competition, entirely apart of its moral aspect, affords in an economic sense an unfair advantage to laymen, who are not hampered by the restrictions imposed by broad, ethical principles. One need only think of the situation developed in several states of the Union, notably California, New York and Illinois, to realize that this uncontrolled medical piracy is actually depriving legitimate physicians of a clientele which by every moral and human law should be theirs. Nor should it be forgotten that the patients are poorly served, since these irresponsible, dangerous and disgusting practices must sooner or later react to the detriment of legitimate physical therapy.

Is there need, then, for any argument that it is high time something be accomplished by the profession to prevent a still greater growth

of that evil? It is clear that the ethical technicians must accept a fixed code for their own security and prestige.

Within the past year a campaign to that effect has been waged by the Congress under the chairmanship of William Bierman of New York, running parallel with the independent investigation by the Council on Education of the American Medical Association. That others have also aided by constructive suggestions is evidenced by the article by Coulter which appears in this issue.

Coulter's tentative plan offers many valuable suggestions, which fully merit serious study and adoption either as presented or suitably modified. Certainly Coulter offers a concrete and workable plan that should receive the hearty approval of every ethical physician and likewise of every ethical technician and aide.

ELECTRICITY IN MEDICINE

From time antedating written records, people residing about the Mediterranean littoral applied shocks from the electric ray of torpedo fish for the treatment of various complaints. The method was mentioned by Pliny in his Natural History and it was recommended by Galen and Paul of Aegina for paralysis, cramps, painful joints, various nervous diseases, headache, gout and infectious fevers.

The true nature of the shocks was not of course known until after von Guericke invented his electrical machine (1672) and Ingenhousz, and John Walsh, independently investigated the phenomenon. They showed the shocks from the fish to be identical with those given by the sparks from the electrical machine. John Hunter (1772) dissected the fish and described the anatomy of the electrical organ which proved to be a modified muscle.

The further discovery of the "frog current" by Galvani, which caused him to believe that electricity is a vital phenomenon, and the demonstrations of Volta, which showed that a continuous current could be produced by chemical means, resulting in the voltaic cell and pile and the "*couronne de tasses*," awakened a tremendous interest in electrical phenomena throughout Europe and America. (1800).

In an age when ignorance of the simplest scientific facts was universal and credulity abysmal, when everything inexplicable was

given fantastic values and explained on supernatural grounds, the possibility of such a mysterious and "subtle fluid" as electricity being able to cure equally mysterious diseases and even to raise the dead found ready and general acceptance.

It is not to be wondered at, therefore, that all sorts of charlatans, quacks, mountebanks and zealous dabblers in mysteries, such as town clerks, pharmacists, physicians, philosophers, members of the clergy, librarians, monarchs, courtiers and even physicians eagerly performed all sorts of experiments upon poor suffering wretches. The result of all this pother and misdirected zeal was nil and electrotherapeutics became an evil odor in the nostrils of the vast majority of ethical physicians.

Fortunately some earnest men gave serious attention to its study registering both failures and successes, so that the few grains winnowed from the chaff were preserved to furnish seed for later harvests. These men kept in step with the advances in the electrical world and even contributed to that science as witness the d'Arsonval galvanometer and high frequency circuit, the Morton static induced circuit, and others that could be mentioned. We must also recall that it was not until physiology and pathology were rationalized, not until biochemistry and biophysics became established, not until bacteriology arose as a science, not until pharmacology and materia medica took their places in medical practice that any claims to scientific medicine by anyone was possible.

With a clearer knowledge of etiology and diagnosis, with a clearer conception of the knowledge of remedies and their actions, with the ability to administer physical and chemical energy in measurable doses, medicine emerged from the shadowy realms of guess, where anyone's guess was as good as another's, into the clear illumination of accurate knowledge and demonstrable facts.

Today we desire to know the nature of the remedy, its effect upon healthy as well as diseased individuals, the reason for selecting or rejecting a remedy for a given condition, the dosage and frequency of administration, its undesirable effects, if any, and the means of avoiding them. Treatment by modern electrotherapeutic appa-

ratus and technic fulfills the above requirements.

It is essential to realize however that one does not prescribe electricity. Electricity is only a very general name covering a multitude of phenomena. In medicine we administer electricity as a means to obtain certain reactions in living cells and tissues and organs. Electricity has no effect of itself but only when it is converted into some other form of energy in the body. It is this transformed energy which is the true remedy in electrotherapeutics. Our cities and homes are traversed by powerful currents of electricity and our atmospheric environment is permeated and aquiver with electromagnetic waves both artificial and natural all entirely unnoticed by us.

When however this energy is converted into mechanical energy it runs our cars, elevators, fans and other machinery. When it is transformed into thermal energy it warms our dwellings and cooks our food. When it becomes radiant energy it illuminates the darkness. When it becomes chemical energy it is used in electroplating and electrochemistry. Electromagnetic energy gives us vision, warms our bodies, awakens chemical processes in plants and affords us radio entertainment.

Electricity in medicine is therefore a mechanical treatment or a chemical treatment or a thermal treatment or a combination of these *and nothing more*. The physiological responses are confined to the functions of the living organs in which this energy is exhibited and vary in degree with the intensity of the application.

Electricity in medicine is therefore no longer a mystery proceeding from a box producing a humming like an angry bee nor a succession of painful electrical sparks given for psychic effects. It is a definite kind of energy. Its effects are known and can be predicted and it can be measured and applied with accuracy and satisfaction for, let us repeat, chemical, or thermal or mechanical effects.

THE NEW YORK CITY MEETING

The Spring session of the Eastern Section of the American Congress of Physical Therapy was held in New York City on April 7, the entire day being devoted to the regional convention. While owing to illness and other causes several prominent members scheduled

to address the eastern confrères, were prevented from fulfilling their engagements, the convention proved so successful in every respect, that, regarded as a forerunner of the national convention, to be held in Philadelphia early in the fall, we may well anticipate another red letter week in the history of our Congress.

Drs. Norman E. Titus and Madge C. L. McGuinness have earned the appreciation of our membership for the interesting material they presented during the clinical part of the program. The attendance at the clinic greatly exceeded the number of registrants, which is officially stated to be 240. Indeed, only an estimate can be made of the actual number of physicians who attended part or all of the sessions, for it became evident that a count was impossible. This, we feel, is convincing proof of the wide interest by the general medical profession in the advancement of scientific Physical Therapy, which, after all, is our main objective.

The problem concerning technicians was presented by Dr. William Bierman in his usual lucid manner. His work on behalf of a friendly and ethical interrelation between the profession and lay assistants is to well known to need further comment. With the exception of a few absentees above alluded to, the afternoon program was carried out as was announced in the March issue of the ARCHIVES. The addresses aroused lively interest, evidenced by a number of critical discussions.

Certainly the activities of our loyal and enthusiastic workers in the East are deserving of credit for the well-directed propaganda on behalf of scientific Physical Medicine and Surgery.

PRIZES FOR OUTSTANDING SCIENTIFIC EXHIBITS AT THE THIRTEENTH ANNUAL SESSION IN PHILADELPHIA

Plans are under way for a series of scientific exhibits for the 13th annual session which will be held September 10, 11, 12, 13, 1934, at the Bellevue Stratford, Philadelphia. Several of the fellows have requested space for special scientific exhibits. Not only has the convention committee seen fit to devote whatever space may be necessary for such exhibits, but it also will present prizes for those exhibits, which, in the opinion of a committee of impartial judges, merit distinction.

No special conditions have been made. The exhibits may be original in character, but need not necessarily be so. The fields included are radiology (X-ray or radium) and physical therapy. Each scientific exhibitor, whether individual or institutional, must set up his own exhibit and be responsible for it. It must be dismantled by 4:00 o'clock on the final day of the meeting. While the fields are limited to some extent, it should be understood that they are interpreted to include any of the medical or surgical specialties in either laboratory or clinical phases. Naturally, physical, chemical and allied branches of physical therapy come within this scope of the work.

The prizes offered are as follows:

First prize: Gold medal.

Second prize: Silver medal.

Third prize: Bronze medal.

Fourth prize: Certificate of honorable mention.

Individuals, hospitals, medical schools, universities and scientific organizations are especially invited to take advantage of this invitation. Reservations for space should be made to the executive secretary, Marion G. Smith and addressed care of the American Congress of Physical Therapy, 30 North Michigan Avenue, Chicago. It will of course be necessary to refuse requests for reservations when available space is taken. Those contemplating exhibits should therefore write for reservation immediately.

Correspondence

March 22, 1934.

Should Congress Sponsor Technician Association?

To the Editor:—I would desire that the members of the American Congress of Physical Therapy fill out this questionnaire and send it to me.

As chairman of the special committee of the American Congress of Physical Therapy appointed to study the relationship between technicians and doctors practicing physical medicine, I desire to learn the reaction of the members of our organization to this situation. May I, therefore, ask you to print the following questionnaire in the pages of the ARCHIVES?

1. Do you feel that a new technician's association should be established?

2. If yes, should this new organization be in the nature of a section of the American Congress of Physical Therapy, or should it be an entirely separate organization, the policies of which are to be controlled by the Congress?

3. Should the American Congress of Physical Therapy register technicians?

4. Do you feel that it would be advisable to combine registration with the formation of a new technicians' association?

5. Do you think that the name American Physiotherapy Association is a good one for a technicians organization, or do you feel that such a name may convey the idea that the members of such a group are physicians practicing physical medicine?

Very truly yours,
WILLIAM BIERMAN, M.D., Chairman,
Committee on Relationship Between
Technicians and Physicians.
471 Park Avenue, New York.

"Breast Tumors and Electrosurgery"

To the Editor:—The editorial "Breast Tumors and Electrosurgery" in the March issue of ARCHIVES, is very interesting and instructive for those who will take the time to digest it. There is no question but what periodic health examinations for all of us will accomplish a great deal. Speaking of breast tumors, the malignant lesion will be treated early in the course of the disease, when a cure may still be expected. It will be a Godsend if the rank and file of physicians would early recognize the importance of tumors of the breast. Only recently a patient was told by a prominent surgeon to forget her breast tumor. This patient came to me later in the hope that I might be able to permanently eradicate her disease, in spite of the fact that metastatic nodules could be palpated above the clavicle. No one realizes better than I do that all of us make mistakes, but that advice seems to me to be absolutely without sense in this day and age.

I have been treating neoplastic diseases for the last seventeen years and have never excised a piece of a tumor from any organ for microscopic examination. As you well say, a piece or portion of a tumor might show only an inflammatory condition or some other benign type of tumor, while other parts of the same tumor might really show highly malignant growth. Newer methods of cutting section for pathological examination have served to remove the possibility of such erroneous pathological conclusions, that is, by microscopic section of the entire tumor or breast. As you know, some authorities state that metastasis may be produced by taking sections, others equally prominent say there is no such danger. Personally, I do not know the proper stand to take, but I do feel that if any mistakes are to be made, we had better err on the safer side for the patient, that is, not take a section because of the possibility of producing a fatal metastasis. The routine procedure of taking specimens in the office, of tumors which may or may not be malignant, is not justifiable since there is a strong feeling that a fatal metastasis may fol-

low incisions into a malignant growth and because it is impossible to give the pathologist a specimen that will permit him to return a correct diagnosis. Therefore the entire tumor or the entire breast is always submitted to the pathologist for examination.

You should be complimented when you state that it is not always safe to remove portions of the tumor by the high frequency cutting current. The high frequency cutting current is so weak in its tissue heating properties as to be of little value in the cure of malignant diseases. Therefore, in my operative work, this weak coagulating, bipolar current is used for skin incisions, so that primary union will follow. Still better is the newer, shorter wave length cutting current applied by a monopolar electrode. Several breast cases operated by monopolar technic have resulted in primary union. Once the skin incisions are made, the rest of the operation is completed with a heavy bipolar coagulation cutting current, because the coagulation produced by the heat of this type of current has great curative properties in malignant disease.

There is another generally recognized procedure which should have been equally stressed in the editorial. To me it is even more important, in so far at least as ultimate results are concerned, than electrosurgery or scalpel surgery, and that is preliminary routine irradiation, first of all the lymphatic drainage areas and finally of the tumor itself. It is felt the best results will follow when this preliminary irradiation is completed within a reasonable time, generally within about two weeks. If operation follows promptly, no healing difficulties will be encountered, while even at this early date the pathologist will find large areas without cellular

elements or malignant cells of lessened resistance in other areas. Follow up records generally show that it is a mistaken hope that any of us can even hope to remove every last malignant cell when metastasis has taken place, by the most widespread dissection that can be done. Since most everyone will admit this, what then is the sense of dissecting the axilla routinely in breast malignancies when there are metastatic nodules in the axilla? Also, when there are no metastatic nodules what is the sense in removing the lymph nodes, when we all learned that their function is to catch and prevent dissemination of disease producing elements? Therefore in my own work at least, preliminary irradiation is looked upon as being the most important part of the management of malignant disease in so far as ultimate cure is concerned. Personally, electrosurgery is always used to remove the primary mass and if the pathologist reports malignant disease, intensive post-operative irradiation is given.

(Signed) J. THOMPSON STEVENS, M.D., New York.

We appreciate the kind comment. In the main we are agreed with our correspondent, so there is no *casus belli*. Editorial articles usually being critical reviews or discussions, naturally technical details are not enumerated as is customary in scientific articles. In the editorial under consideration the title showed its scope to be the relation of electrosurgery to breast tumors, diagnostic and therapeutic, which, of course, precluded discussion of pre- or post-operative irradiation.

EDITOR.

SCIENCE, NEWS, COMMENTS

Medical Study Trip to Hungary

At the invitation of the Hungarian Medical Postgraduate Committee of Budapest, Professor Emil de Grosz, President, and of the Association "Budapest Town of Medicinal Springs," Archduke Dr. Joseph Francis, chairman, a medical study trip to Hungary is being organized. The plans provide for a fortnight visit to Hungary during which there will be postgraduate lectures and demonstrations in English at the principal University clinics and at the municipal thermal baths and springs. Reduced railroad fares and hotel rates are granted by the Hungarian Government. The party will sail from New York on August 18, 1934, visiting Munich and Oberammergau en route. The return trip may be made, optionally, via Berlin, Paris, or Italy. The contemplated date of return to New York is September 30th.

The Committee on Arrangements for this trip is composed of Drs. Harlow Brooks, Charles G. Kerley, Jerome M. Lynch, Wendell C. Phillips, Erwin Torok, and Richard Kovacs, 1100 Park Avenue, New York, Secretary.

Operating Risk Now Mathematically Calculated

A new yardstick of safety for the operating room was described at the Congress of Anesthetists by a British anesthetist and physician, Dr. W. Stanley Sykes of Leeds.

With this yardstick, called the energy index, surgeons and anesthetists can determine with mathematical precision the risk of operating on any patient. The exact load under which the patient's heart is working can be checked as accurately as an engineer can check on the load of a dynamo in a power plant.

The test gives in millimeters of mercury the mathematical load under which the patient's heart is laboring. The index is determined by adding the systolic and diastolic blood pressure readings and multiplying the sum by the pulse rate. As the heart's load increases or decreases from the normal of 14,400 millimeters per minute, the risk the patient runs in being operated on becomes greater. If the reading is higher than normal, it is because the heart has enlarged to take care of a greatly in-

creased load of work. If the reading is lower than normal it is because the heart has given out entirely under the load and the energy it can expend has decreased. — *Science News Letter*, November 4, 1933.

Electrical Instruments Used to Study Currents in Brain

Electrical instruments so delicate that they will register a millionth of a volt are being used to explore microscopic areas of the brain, Prof. C. Judson Herrick, of the University of Chicago, told the American Association for the Advancement of Science. Information thus obtained is expected to revolutionize our whole language of the way the human mechanism works.

"I venture the prediction that the electrobiological era now beginning will yield as revolutionary changes in our conceptions of the physiology of the nervous system as the invention of the microscope inaugurated in anatomy," Prof. Herrick said.

There are from ten to fourteen billion nerve cells in the cerebral cortex — the part of the brain with which we think — and they are arranged in definite patterns. It is the little electric currents that flow from cell to cell and from group to group that the new electrical methods are measuring.

This new knowledge of inter-cell telegraphy in the brain promises to yield positive results in understanding differences in behavior between man and his evolutionary cousins, the higher apes, and among the human races themselves, that the older methods, which depended on the study of the grosser features of the brain, could only block out roughly. — *Science News Letter*, July 1, 1933.

Freshness of Fish Measured Electrically

Determining the freshness of fish by electricity is the latest achievement of the U. S. Bureau of Fisheries. Maurice E. Stansby and James M. Lemon, at the Bureau's Gloucester laboratories, needed a quick, accurate method for telling just how long a fish had been out of water.

They found that the fish, soon after being caught, became stiff, then as time went on, relaxed and became more and more limp 'till finally it began to decay. They knew that the stiffness was caused by the production of lactic acid, the "sour" of sour milk, which caused the muscles to become rigid. Then, as this disappeared and the muscles were attacked by their own juices, they became limp.

How to follow this process more exactly than was possible by simply seeing how limp a fish became was the problem. Stansby and Lemon solved it when they found, as was predicted by theoretical chemistry, that they could pass more electricity through a fresh fish than through one that had been caught some time.

The apparatus they use is one that is familiar to radio men and telegraph engineers. It is called a Wheatstone bridge, and is an instrument that measures just how much resistance is offered to the electric current by the material being tested; in this case, some of the fishes' muscles ground up with water. — *Science News Letter*, December 2, 1933.

Most of Maternal Deaths Found to be Preventable

Nearly two-thirds of the mothers dying in childbirth could have been saved if they had had proper care, a committee of the New York Academy of Medicine has found after a three-year survey. Physicians were held responsible for three-fifths of the preventable deaths. The patients themselves were responsible for more than a third of these deaths and midwives for about two in every hundred. Lack of judgment, lack of skill or careless inattention to the demands of the case were faults of the physicians. The patients' fault was failure to take advantage of facilities at hand for safeguarding them.

The committee believes that the number of deaths can be reduced by reducing the amount of surgical interference during birth. Surgical procedures are resorted to four or five times oftener than actually necessary. The death rate is five times as high as in spontaneous births.

Comparing the number of deaths of hospital births with home births, the committee found that the increase in hospitalization failed to reduce sickness and deaths as much as had been hoped for. However, it was observed that generally only normal, uncomplicated births take place in the home. — *Science News Letter*, December 2, 1933.

Normal Tissue Extract Checks Growth of Tumors

Certain types of cancerous tumors have their growth checked by the injection of an extract made from normal growing animal tissues. At the meeting of the National Academy of Sciences in Cambridge, Mass., Dr. James B. Murphy of the Rockefeller Institute for Medical Research, New York City, told of the latest work on this substance, whose effects are partially known but whose chemical composition is still wholly in the dark. Dr. Murphy has worked with tumors in mice and his research is not yet ready for application to human cases.

The tumor-inhibiting substance has been found in tumors themselves, and an inhibitor, which may be the same or may be a different substance producing similar results, has also been found in placental tissues and embryo skin. When these normal tissue fractions were used on natural or spontaneous cancer of mice, "their inhibiting action is evident not only on local post-operative recurrences of the disease and on the growth of autografts where there is direct contact between the extract and the cancer cells, but is definitely observable when the test fluids are injected at a distance from established tumors," said Dr. Murphy. "While the results seem to substantiate the suggestion that the inhibitor from tumors is similar to the balancing factor of normal tissues, and would give a possible insight into the mechanism involved in malignancy, the materials involved are too complex to justify a conclusion at this time." — *Science News Letter*, December 2, 1933.

THE STUDENT'S LIBRARY

ESSENTIALS OF MEDICAL ELECTRICITY. By *Elkin P. Cumberbatch, M.A., B.M., (Oxon), D. M. R. E., (Camb.), M. R. C. P.*; Medical Officer in Charge, Electrical Department and Lecturer on Medical Electricity, Bartholomew Hospital, etc. Seventh Edition. Cloth. Pp. 508 with 15 plates and 132 illustrations. Price, 10/6. London: Henry Kimpton, 1933.

The fact that this work has reached its seventh edition is an index of its popularity and of its practical value. This however is to be expected since it is written by one of the foremost authorities on medical electricity. The author besides materially revising and enlarging the text has devoted increasing space to the exposition of high frequency current. Instead of the single chapter of the previous edition this section is now represented by seven new chapters, forming a detailed review of its medical and surgical possibilities. In this connection the author offers a new and interesting thought to the subject. Since the therapeutic action of high frequency current is in a manner associated with a thermic effect, it is suggested "that the various ways of using these currents should be known as the *Electro-thermic Methods of Medicine and Surgery.*" This, however, besides adding to the burden of an already overloaded nomenclature will be objected to in certain quarters because galvanotherapy also has a thermic effect and is truly electrical in action. Moreover, many students feel that it is now high time that more of correlation and less of differentiation be the theme of our medical writings. In the light of existing knowledge it is debatable whether the action of high frequency current is dependent upon thermal effects, or the thermal effects are due to physico-chemical changes produced within the dynamic organs of the body. The mystery of the action of physical agents is still in need of scientific explanation. Existing explanations are no deeper than the microscope and this is superficial indeed where one is concerned with the action of electricity and its influence on the finer structures of the body. The author will be the first to agree that dogmatization and speculation have no place in scientific medicine. The work as a whole, however, merits highest praise. In the space of 24 chapters and an index, the best and approved essentials of medical electricity are presented in clear diction, covering in detail a discussion of the various agencies, techniques, indications and contraindications, physiological and surgical action, forming a splendid reference and authoritative text on the subject.

RECENT ADVANCES IN RADIUM. By *W. Roy Ward, M.B., B.S., M. R. C. S.,* Medical Director and Surgeon to the Radium Institute, London; and *A. J. Durden Smith, M.B., B.S., M. R. C. S.,* Surgeon to the Radium Institute, London. Cloth,

Pp. 324 with 4 colored plates and 140 illustrations. Price, \$5.00. Philadelphia: P. Blakiston Son & Co., Inc., 1933.

The spontaneous emission of energy from substances of known matter was a contribution of vital importance to medicine. It has opened up a potent therapy to the credit of the Curies and the pioneers of this field. The foregoing work is the exposition of the recent and permanent advances in radium. In the short span of its history an extraordinary amount of clinical material has been published regarding its practical use in medicine, much of it being based on empiricism. Nevertheless, between the enthusiasm of its advocates and the unjust criticism of its opponents, a science based upon mathematical principles has arisen which bids to outlast the changing opinions of contemporary medicine. As the authors point out, . . . "recent work has been done toward establishing technic and dosage on a surer footing, so that the present appears a suitable time to review the past, to assess its present possibilities, and to foreshadow its probable future in certain directions." To expatiate upon these points and to stress the desirability of co-operation between the surgeon, internist and radiologist has been the reason for this work. The contents are divided into three sections, the first dealing with the manufacture of radium, its physical nature and action, the radio-sensitivity of tissues, the dosage, apparatus and protective measures used, etc. The second part discusses in great detail the methods adopted in the various leading radium clinics in the treatment of malignant conditions, such as the breast, uterus, mouth, rectum and other parts, this forming the major thesis of the book. The third concerns itself with the treatment of non-malignant and the border-line lesions, such as control of uterine hemorrhage, tuberculous adenitis, angiomas, and papillary and hyperkeratotic lesions, etc. The discussions are couched in such cogent and comprehensive descriptions and are illustrated in such a clear fashion that it can readily be conceived as a work which will become the authoritative text on this important subject. There is in index of authors and subjects.

INSIDE THE ATOM. By *John Langdon-Davies.* Cloth. Pp. 184 with 61 illustrations. Price, \$2.00. New York and London: Harper Brothers, 1933.

The individual who has adjusted himself to a routine and more or less peaceful state of life would be startled to know that in Nature there is no peace, no rest, but a continuous and orderly activity out of which biologic and inorganic processes evolve at the expense of constant adaptations and arrangement of forces. Nowhere is truth stranger than fiction than the recital of the facts of that intriguing

microcosm existing within the atom. This the author explains in non-technical language, so that even those least experienced may understand. The contents of this work are divided into three sections explaining respectively "Nature's building bricks,"—the atoms, what is inside of them, and the relation, action and effect of radiation. It is a story of the magic of science, as fascinating in its recital and development as the best of mystery stories; and affords the reader a comprehensive introduction to an important branch of knowledge.

A TEXT-BOOK OF PATHOLOGY. By *Francis Delafield*, M.D., LL.D., Professor of the Practice of Medicine, College of Physicians and Surgeons, Columbia University, New York; and *T. Mitchell Prudden*, M.D., LL.D., Professor of Pathology, College of Physicians and Surgeons, Columbia University, New York. Fifteenth Edition, Revised by *Francis Carter Wood*, M.D., Director of the Pathological Department, St. Luke's Hospital, New York, and Director of the Institute of Cancer Research, Columbia University, New York. Cloth. Pp. 1253. With 20 full-page plates and 830 illustrations, in black and color. Price \$10.00. Baltimore, Md.: William Wood & Company, 1931.

The recent edition of this work shows that it still maintains its position as an authoritative text for students and practitioners of medicine. It is a tome extensive in its scope, concise in exposition, and superior in its detail to many in current use on library shelves. The four years which have elapsed since the publication of the Fourteenth Edition have been replete with discoveries of extraordinary importance in medicine, but little has been added to morphological pathology from the point of view of the student of the rudiments of the subject. Thus the recent revision of the text has not been extensive, but has covered the essentials. The changes which have been made are found especially in the chapters on the blood, circulatory system, urinary organs, and the bones. Additional references have been inserted, chiefly to recent monographs, which give useful reviews on some particular phase of pathology. The subject matter is divided into three parts. The first part is concerned with general pathology, which covers pathological processes in general (regardless of the organs concerned), terms of pathology, and the laws of morbid phenomena. The second has to do with special pathology, that is, the study of the diseases of specific organs with special reference to their structure and how their function is affected thereby. The last and shortest part is concerned with the method of making post-mortem examination, a section of special interest and value to those doing autopsies.

THE SCIENCE OF RADIOLOGY. Edited by *Otto Glasser*, Ph.D., Cleveland Clinic Foundation. Contributors: *Harry H. Bowing*, M.D., Rochester, Minn.; *Percy Brown*, M.D., Egypt, Mass.; *James T. Case*, M.D., Chicago; *Ernest E. Charlton*, Ph.D., Schenectady, N. Y.; *George L. Clark*, Ph.D., Urbana, Ill.; *Arthur H. Compton*, Ph.D., Chicago; *William D. Coolidge*, Ph.D., Schenectady, N. Y.; *William A. Evans*, M.D., Detroit, Mich.; *Gioacchino Failla*, D.Sc., New York; *Robert E. Fricke*, M.D., Rochester, Minn.; *Arthur W. Fuchs*, Rochester, N. Y.; *Otto Glasser*, Ph.D., Cleveland, O.; *J. Cramer Hudson*, Ph.D., Boston, Mass.; *Jans A. Jarre*, M.D., Detroit, Mich.; *Ed. C. Jerman*, Sc.D., Chicago; *Matthew Luckiesh*, Sc.D., Cleveland, O.; *George M. MacKee*, M.D., New York; *Willis F. Manges*, M.D., Philadelphia; *Hermann J. Muller*, Ph.D., Austin, Texas; *Charles Packard*, Ph.D., New York; *Ursus V. Portmann*, M.D., Cleveland, O.; *Edith H. Quimby*, M.A., New York; *William Seifriz*, Philadelphia; *Edward H. Skinner*, M.D., Kansas City, Mo.; *Lauriston S. Taylor*, Washington, D. C.; and *David L. Webster*, Ph.D., Stanford University, Calif. Cloth. Pp. 450 with 108 illustrations. Price \$4.59. Springfield, Ill., and Baltimore, Md.: Charles C. Thomas, 1933.

This book deserves highest praise, not only because of the timeliness of the topics under discussion, but because it has brought down to date the essential facts about radiation phenomena. It presents a closely knitted review of the evolution, the historical progress and the action of radiant energy from the far infra-red region to cosmic rays, not even omitting the mysterious action of the Gurwitsch rays. Specifically this work presents objective evidence of the extraordinary and fertile labors of the individual discoverers and of the American pioneers in roentgen and radiation phenomena, and the organized knowledge that has raised it to a science of radiology. It has incorporated special discussions regarding the physical nature of x-ray and radium, the mechanical structure of roentgen ray apparatus, its dosage, biologic effects, diagnostic values and therapy. In the space of twenty-five chapters the reader obtains an inspirational picture of the solidity of this discipline and its extraordinary usefulness in medicine and in industry. By way of criticism we hold with Spencer that a science must of necessity embody organized knowledge, not mere knowledge, this point being directed to the loosely worded definition in the foreword. Altogether this work is deserving of such high praise that academic tilting would be out of place were it not that such a flaw in so prominent a position will produce a false impression of the main thesis of this valuable contribution.

INTERNATIONAL ABSTRACTS

Transurethral Prostatectomy: Indications and Limitations. J. Hoy Sanford.

J. Missouri S. M. A., 30:479, (Dec.) 1933.

After a careful analysis of the subject, Sanford's conclusions are:

1. Individualizing the prostatic patient as to the type of surgery he is best suited for (transurethral or open surgical removal) appears to me as being wise and sound logic.

2. Transurethral surgery is here to stay. In a goodly percentage of cases it is admirably suited. In the larger obstructions as studied by a cysto-urethroscopic examination and found alone or in combination which represent large lateral lobe involvement with a deep cleft above, marked median lobe enlargement or decided intra-urethral encroachment, open surgical removal of the gland is my choice.

3. Finally, I should like to pay my respects to such eminent authorities as Caulk, Davis, McCarthy, Braasch, Bumpus and Thompson, Alcock, Folsom, Kretschmer and others who at present seem to have taken the lead in this class of work and in whom a personal adaptability to do all types of obstruction has been developed. Either they will eventually realize the inefficiency of transurethral surgery in the large obstructions, or make such conservatives as I recognize our inability to develop this personal adaptability or put more effort into its accomplishment when once convinced.

If transurethral surgery in the larger obstructions proves as good in immediate and late results as prostatectomy and appreciably reduces the mortality rate then I think we will have reached a degree of perfection in this type of surgery that would be unchallenged.

I have consistently followed the old adage. "Never be the first to accept the new nor the last to discard the old."

The High Frequency Field as an Agent in Changing the Cataphoretic Velocity and the Localization of Streptococci. Charles Sheard.

Proc. Staff. Meet., Mayo Clinic, 8:496, (Aug. 16) 1933.

Pratt, Rosenow and the author presented the results of recent investigations concerning the possibility of modifying the cataphoretic velocities of streptococci when treated in vitro by short electric waves, the correlation between the states of electrification of the streptococci, as evidenced by changes in cataphoretic measurements, with their biologic activities, and, finally, the character of the strains of streptococci (as judged from cataphoretic measurements) recovered from specific localities in animals which have been given injections of microorganisms treated in the high frequency field.

The Local Treatment of Laryngeal Tuberculosis. E. Wessely.

Wien. dem. Wschr., 16, 1933.

The local treatment of laryngeal tuberculosis promises successful results (about 30 per cent) only when the pulmonary tb. tends to be latent, when the temperatures are only slightly subfebrile, and the erythrocyte sedimentation rate (ESR) is at the most 25 mm. in 45 minutes (*Westergreen-Poindecker's method*). If the general condition is very good and the ESR under 15 mm., the excision of small, well demarcated infiltrates, e.g., on the epiglottis or on the posterior wall of the larynx promises well. More extensive infiltrates, granulations and ulcerations can be treated by electrocautery when the ESR does not exceed 20 mm., even though the general condition is not very good. We distinguish superficial cautery for ulcerations and granulations and deep cautery for infiltrates. Electrocautery is inadvisable if the process is too extensive or if it is located over hyaline cartilage (injury to cartilage can lead to severe perichondritis) or on the commissura anterior of the vocal cords, since the process of cicatrization can lead here to adhesion of the vocal cords, formation of stenoses and loss of the voice. Cold cautery (diathermy) comes into consideration chiefly when small scars are important, and especially for the correction of scarred processes. — Extensive infiltrations without a tendency to decomposition will often respond nicely to »fractionated« x-ray doses (one to several tenths of the S. E. D. in four to six weeks intervals repeated several times). — The results of light therapy (analgetic, scar-forming) are excellent, especially in cases of extensive ulcerations. Natural or artificial sunshine is sent directly (*Seiffert's method*) or by means of a laryngeal mirror into the larynx. — It is often good to use several methods at the same time. A silence or whispering cure is absolutely necessary to rest a diseased vocal cord.

Symptomatically, to combat the pains in swallowing, before meals: Instillations of 10 to 20 per cent menthol oil, Anaesthesin (Euphagin tablets), Orthoform (a pinch is allowed to dissolve slowly on the tongue and then swallowed, or the substance is blown into the larynx by an insufflator while the patient says »a« as in »hay«), cocaine in the form of Psikobenzyl tablets, which can also be powdered and insufflated, or 3 to 5 per cent cocaine solution as spray or for painting. Every second day, the ulcers which have been anaesthetized are dabbed with lactic acid 25 per cent, 50 per cent and later 80 per cent. The pain then stops permanently in two to three weeks, even though the ulcers show no macroscopic change. In cases of ulcers on the entrance to the larynx and of perichondritis of the arytenoid cartilage, the blocking of the superior laryngeal nerve through the injection of 1 to 1½ c. c. 85 per cent alcohol at the site of the hyothyroid membrane (also bilateral, but not at the

same time) will help for weeks to months. The injection may be made only when the irradiation of the pain into the ear signals the correct position of the tip of the needle on the nerve. This irradiation into the ear may sometimes be provoked only after several drops of alcohol have been injected. — *Ars Medici*, 11:418, (Sept.) 1933.

Treatment of Scars and Keloids. R. O. Stein.

Arzt. Prax., 7:12, 1933.

Scars are the outcome of the destruction of the papillary layer of the skin. The more superficial ones become apparent by pigmentation of various degrees. The condition may be corrected by the application of aqueous solutions of sodium borate, corrosive mercuric chloride, bismuth ointment, hydrogen dioxide preparations, and weak acids. Quartz light application is often useful. Projecting or depressed scars, like those after acne vulgaris, varicella, and variola, need first be softened and smoothed out; this may be accomplished by using Unna's pepsin poultices. They may also be treated with repeated scarifications or application of carbon dioxide snow, although the author found diathermy to be also effective. Fixed scars may be mobilized by injecting potassium iodide solution into the underlying tissues. More extensive scars yield better to irradiation, preferably unfiltered rays for the newer ones and filtered rays for the older, keloid scars, care being taken to protect the surrounding areas. — *J. P. T. M. Assoc.*, 13, (Sept.) 1933.

Vital Reactions of the Pulp of Teeth in Syphilis Produced by Induced Currents. A Preliminary Report of One Hundred and Ten Cases. William R. Pentz.

Arch. Dermant. and Syph., 28:163, (Aug) 1933.

The apparatus used is the ordinary laboratory 2 volt dry cell, connected with a common induction coil which is so arranged that the voltage may be increased or decreased as desired. It is the ordinary coil used in laboratories, at one end of which a make and break key or vibrator is attached. The electrodes are of the common two point type. The dry cells are changed every three months to insure the use of a standard voltage at all times.

The method of testing the teeth is simple. After the current is turned on, the smallest amount of current necessary to cause a sensory reaction of the pulp is used. This is done for each tooth, and the result is tabulated immediately. Only teeth free from fillings and caries are tested, in order to avoid any hypersensitivity or lessening of the sensory activity. Hopewell-Smith contended that caries and fillings in teeth produce pathologic changes in the pulp and hence change its sensitivity. The teeth used in this test are those from the second premolar to the second premolar, inclusive, in both the upper and the lower jaw. The controls were teeth of normal persons; the teeth selected were the same and answered the same requirements. The students of the Temple University School of Medicine sub-

mitted to the control tests. Pentz arrives at the following conclusion:

1. In normal persons there is a variation in the pulp of the teeth which falls within definite limits.

2. In syphilitic infection the secondary stages show a definite variation in some persons that is not paralleled in others.

3. Patients with congenital syphilis are not all dentally affected by the disease. The question as to why this should be so gives us an interesting field for speculation on which some light may be thrown by my experimentation with animals.

4. An unexplained variation in the reactions of the pulp occurs in secondary syphilis.

5. The results up to this time indicate that in persons with secondary syphilis whose dental pulp varies greatly from the normal the infection may have a distinct predilection for nerve tissue and may tend toward neurosyphilis as its ultimate manifestation.

Treatment of Urethral Strictures of Small Caliber by a New Method. Preliminary Report. Leander William Riba, and J. Everett Sanner.

J. Urol., 30:361, (Sept.) 1933.

The authors feel that small caliber strictures can be enlarged very easily with only one electrosection treatment. This procedure is not recommended to displace the use of urethral sounds. They believe, however, that the usual course of urethral dilatations may be materially shortened if the small caliber strictures are first sectioned. They found that subsequent sounds may be passed very readily and without apparent difficulty. There has not been any indication that more scar tissue is likely to form following an electrourethrotomy. In cases of large caliber strictures and infiltrations they believe this procedure has little value. In a patient, who has a strictured urethra and for some reason or other (renal colic, hematuria or injuries) needs an immediate cystoscopy, they feel that this method of handling the stricture would be the procedure of choice. From an economic standpoint, many patients can be kept out of a charity-bed hospital, or their hospital stay reduced to a minimum of a day or two by this new method.

Lupus of Palate, Pharynx and Larynx. (Further report of Case Previously Shown.) J. F. O'Malley.

Proc. Roy. Soc. Med., 26:1321, (Aug.) 1933.

A male, aged 42, was shown (May 2, 1932) with extensive superficial ulceration of palate, fauces, pharynx, epiglottis, arytenoids and larynx, with marked loss of voice. At present he is much improved, following ultraviolet irradiation by Dr. Beaumont at the Sunlight Clinic at Camden Road, who pointed out that this was the first case of lupus of the larynx which he had seen, as he was not a laryngologist, and he had found it necessary to evolve a special technic. He had there-

fore designed a silvered quartz applicator for use with a new form of water-cooled mercury vapor arc lamp. With this it was possible to get the short ultraviolet rays in close contact with the lesion. The treatment given in this case was for three minutes, three times a week, for the first two months, then twice a week, and eventually once a week. In addition prolonged general body irradiation was given three times a week. This was suitable for other forms of tuberculous conditions of the larynx.

The lamp consisted of a small mercury arc enclosed in a quartz casing which was introduced into the mouth. Because of the possibility of danger to the patient in his opinion any lamp of this design introduced an unnecessary risk. It was because of this that the technic was evolved. The special quartz solid rod was designed so that the mercury vapor arc itself need not be introduced into the mouth. The radiation from the end of the quartz rod was approximately the same in wave length as from the arc itself, and was in the region of 1800 A. U.

Loss of Actinic Sunshine as a Health Problem of Cities. Fred O. Tonney.

Am. J. of Pub. Health, 23:775, (Aug.) 1933.

The needs of the body for lime salts may be classified conveniently as: (1) Those of the periods of heavy calcium demand, namely, (a) growth, (b) expectant motherhood, (c) lactation; (2) those of tooth development and preservation; (3) those concerned with the resistance of the body to bacterial invasion.

This, then, is the public health problem, dealing with the calcium derangement of a significant part of the urban population, due in the last analysis to deficiency of actinic sunshine during a considerable portion of the year. The normal seasonal duration of deficient sunshine of perhaps 2 or 3 months, appears to have been at least partly provided against in nature's plan, by storage of vitamin D in the tissues of the body. The prolongation of this seasonal low period by 2 to 4 additional months, due to occlusion of actinic sunshine by smoke, is probably a factor in bringing about the unfavorable physiological actions of calcium unbalance. Such a conclusion seems reasonable, since evidences of calcium derangement are far less prevalent in rural than in urban districts. As to specific remedies, the author suggests:

1. Climatic surveys of cities to determine: (a) the normal seasonal actinic deficiency. This can perhaps be most simply accomplished by measuring the angle of incidence of the sun's rays at noon and recording the number of months of the year in which it is below 35 degrees from the horizontal; (b) determination of the actinic loss of sunshine due to smoke, which is estimated by comparison of simultaneous readings in urban and nearby rural testing points. For this purpose there are available the simpler actinic methods and the portable spectrographic method now developed to a practical stage for field work.

2. Education of urban populations in the health value of the out-of-doors, with specific information on the local daily actinic value of sunshine.

3. Provision of substitutes for actinic sunshine, such as ultraviolet lamps in infant welfare centers and free distribution of cod liver oil or vitamin D foods during the prolonged overcast season. Cincinnati, Pittsburgh, and Chicago have been using some of these measures.

Pulmonary Tuberculosis of Childhood. S. M. Welsh.

Wis. M. J., 32:308, (May) 1933.

Prophylaxis is of utmost importance in the control of tuberculosis. It is necessary to educate the people in order to bring this about and this is quite adequately done by the various Anti-Tuberculosis associations who came in contact with the children and their parents through the schools and who teach them the nature, manner of spread, and control of tuberculosis. In order to control the disease, active patients must be taught not to cough in public without covering their mouths and the proper manner in which to dispose of their sputum.

The treatment of the child sick with the disease can be briefly stated as being hygienic. Plenty of rest, fresh air, and abundant food are the essential elements necessary. Whether a child should be institutionalized depends upon the circumstances found in each family. Discipline and education are the only factors in favor of an institution, provided the family is able to meet the necessary requirements of essential rest, food and fresh air at home.

Medication plays a small part in the treatment. Vitamin therapy may be of value for its nutrient effect and some recent work tends to show that Vitamin D tends to produce an increased calcification in tuberculosis. The question of heliotherapy is somewhat disputable, although it is generally stated to be contraindicated in the adult type but indicated in the childhood type. Surgery, of course, plays no part in children unless the advanced adult type of lesion is found.

A Treatment of Sydenham's Chorea. Donald Bateman.

Brit. M. J., 96:1003, (June 10) 1933.

If there could be discovered a satisfactory method of treatment that would bring about a quicker cure it would be a source of great economy and convenience, as well as of satisfaction to the patient's parents. The possibility that there is such a method has now been demonstrated with success by Dr. Lucy Porter Sutton of Bellevue Hospital, New York City. It was observed by her that an intoxication with fever resulting from phenobarbital therapy, when occurring in a case of chorea, caused a reduction in the choreic manifestations. The conclusion was drawn that the fever itself was responsible for the effect. On this basis it appeared that the deliberate provocation of fever during the course of an attack

of chorea would be a beneficial therapeutic measure. This proved to be so. The induction of fever is now used as a routine procedure in the treatment of chorea in the Children's Medical Service of Bellevue Hospital. It is upon the observations of Dr. Sutton's methods and the experience derived from a number of patients with chorea whom it was my privilege to treat under her direction that this report is made.

Fever is induced by a triple typhoid vaccine containing 1,000 million typhoid and 750 million each of paratyphoid A and B bacilli per cubic centimeter. Other methods of causing artificial fever have been used and are at present being investigated, but the typhoid treatment is at present most commonly employed.

Most patients show a marked improvement after two or three treatments, and are usually free from choreic movements in a week. As would be expected, the milder cases improve more quickly than the severe ones. Patients with a long history of chorea before admission to hospital may be slow in their response to treatment, and it should be remembered that in these patients habit movements may be superimposed upon those that are essentially of choreic origin. At the end of the fever treatment the patients are kept in bed for a few days and are then allowed up for a week before discharge from hospital. The usual length of stay in hospital is three weeks. This compares very favorably with the seven weeks which most other modes of treatment require. Mention may be made of those cases of chorea which on admission to hospital show a cardiac murmur of rheumatic origin. This need not be regarded as a contraindication to treatment, unless it is thought that the circulatory system cannot support the effect of a high fever. The treatment so far has proved satisfactory. It has considerably shortened the duration of stay in hospital and is not accompanied so far as is at present known, by complications. The patient's discomfort attendant upon the treatment is much less than might be expected, and is probably preferable to the weeks in bed and long continuance of the choreiform movements associated with other methods. [This provocation report suggests the possibility of electric hyperpyrexia as a better method of control.—Ed.]

Treatment of Gastric Ulcer by Diathermy of the Sympathetic and Parasympathetic. R. Groth, and P. Jagrow.

Münch. Med. Wochenschr., p. 343, (Mar. 3) 1933.

Strikingly successful results are reported in a preliminary communication by the authors in the treatment of a variety of cases by diathermy

applied in the cervical region. Two electrodes, 5 by 10 cm. are placed on either side of the neck along the sternomastoids and current strengths of about 0.5 to 1 ampere are employed. The effect of these currents is in part upon the vago-sympathetic, and the improvement in the cases so treated is referred to influences exerted upon the effector organs associated with these nerves. In fifty cases of gastric hyperacidity (twenty with haematemesis and blood in the stools, associated with gastric or duodenal ulcers diagnosed by x-rays or operation; thirty cases with spastic pains, pylorospasms, etc.) the application of the treatment for twenty to thirty sittings of about thirty minutes each was followed by remarkable improvement. The gastric pain disappeared, and in most of the cases the pyrosis and regurgitations ceased and the free acidity of the gastric contents diminished, frequently to normal. Gastric syndromes with lessened acidity were unaffected by this procedure. Especially noteworthy were the effects produced in cases of epilepsy; the attacks in most instances disappeared completely after a few applications of the current. Diathermy of the lumbosacral vegetative centers also led to very good results in affections of the pelvic organs, the lower limbs, and even in cases of myelitis. In such cases the electrodes are placed one over the affected area in the lumbo-sacral region and one in the rectum. Indications are further discussed by the authors for a more extended use of this method, particularly in the thoracic, abdominal and cranial regions.

The Management of Benign Prostatic Obstruction. Howard L. Tolson.

W. Va. M. J., 29:479, (Nov.) 1933.

The author reviews this subject at length and then concludes:

1. Transurethral prostatic resection is the method of choice in relieving minor forms of vesical outlet obstruction, i. e. contractures, bar formations, slightly or moderately enlarged median lobes and small lateral lobes.

2. By doing more extensive resections, removing larger amounts of tissue, and by doing multiple operations in some instances the transurethral method may be successfully applied to patients with large hypertrophied prostates. It is not a method of choice, however, in dealing with the very large or grade 4 type of enlargement.

3. Fifty per cent or more of patients who present themselves for the relief of benign prostatic obstruction can be satisfactorily relieved by instrumental resection.

4. Complete enucleation of the prostate remains the operation of choice in cases with very large prostates provided the patients are in operable condition.

SURGICAL TUBERCULOSIS *

ITS TREATMENT BY CLIMATE AND SUNLIGHT DURING 47 YEARS (1886-1933)

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For nearly fifty years I have intensively busied myself with the treatment of surgical tuberculosis. If my expositions contain a pronounced personal characteristic, so that the word "I" occurs perhaps too often, I ask that this be not attributed to me as immodesty, nor should it be regarded as an oration *pro domo* if I emphasize the advantages of high mountains for heliotherapy — my home and place of work.

The sunlight treatment of surgical tuberculosis is the outgrowth of climatodietetic therapy and of the open air treatment, which has first been so successfully used by Herman Brehmer, in 1854, in his famous sanatorium Görbersdorf in Silesia (561 meters above sea level), and about ten years later by Alexander Spengler in Davos (1560 meters above sea level), in cases of pulmonary tuberculosis.

Twenty years after Spengler, I introduced the treatment, which gave splendid results in pulmonary tuberculosis, also for surgical tuberculosis, for I accepted that while in the latter there was a difference in site, the disease was one and the same. When one differentiates surgical from pulmonary tuberculosis, the adjective "surgical" implies only a possible surgical approach. As a student in the early eighties of the last century I had occasion often to see surgical cures of Italian visitors suffering from lung trouble, who spent the winter in a small colony in my home town, Samaden, (1720 meters above sea level). When I next saw in Kocher's clinic the varied operations for surgical tuberculosis — which disease then constituted the principal activity of the clinic—I asked myself whether this class of patients could not be more benefited by climatodietetic therapy and many a mutilating operation avoided thereby. The postmortem table, too, taught us daily that tuberculosis is a spontaneously curable disease, for the majority of corpses testified by scars or calcified nodules to previous

tuberculous foci which had healed spontaneously.

At that time, soon after the introduction of the antiseptic method, our feeling of security in connection with it brought about an extraordinary operative tendency in surgery. For tuberculosis there long prevailed the concept to operate radically, similarly as for malignant tumors; that is, to extirpate the diseased tissue by operating with scissors and scalpel widely through healthy tissue, thus removing everything pathologic with one stroke. Extirpations, arthrectomies and resections were the rule, and amputations were performed all too frequently. Thousands of patients suffering from surgical tuberculosis left the hospitals every year with stiff and shortened extremities; that is, more or less crippled, while thousands of sufferers from pulmonary tuberculosis, often of grave form, were cured in the high mountains by hygienic and dietetic therapy. Based on these considerations, I took measures immediately after my entering practice in Engadin, in the Spring of 1886, to accord also sufferers from surgical tuberculosis the benefits of the high mountains, and as there was no hospital, I took patients to my parental house. My efforts were supported by great surgeons, such as Albert, Esmarch, and Socin. At that time there were already surgeons who were not satisfied with the operative results in surgical tuberculosis. "Surgery then," to cite v. Czerny, "looked for an ally who could save it many a hopeless or dangerous intervention, and make secure some laboriously attained success."

Sunlight and Climatotherapy

As the best allies have proved to be favorable climate and the old-tried sunlight, it nevertheless required much time until this conservative point of view gained ground. Today that conservative surgeon is in the right who, adhering to the natural healing of tuberculosis, places general supportive treatment in the foreground, and conceives his

* Translated by an Associate Editor.

operative measures more as a support of the latter.

Despite the fact that lung surgery at present plays a great and successful rôle, tuberculosis of the lungs, considered in a *direct* sense, is still a "*noli me tangere*" for the surgeon. The exposure and drainage of a cavity is not a radical, but only a palliative operative, and the artificial production of a pleuritis or of a pneumothorax are merely therapeutic measures copied from the natural healing processes. Freund's chondrotomy, Friedrich's thoracoplasty, and the cavity fillings, also are only mechanical auxiliary operations, the former for the better development, and the latter for the immobilization of the lung, in order to stimulate healing or to overcome threatening hemorrhages. In this category belong in the sense of narrowing the field of the lung, the exclusion of the phrenic nerve (exhaireisis). But the healing proper is left to climatodietetic therapy. For this reason the treatment of pulmonary tuberculosis with artificial pneumothorax, thoracoplasty, etc., has found employment especially in the lung sanatoria in the high mountains, e. g., Davos, Arosa, Leysin. Here, too, we see how climatotherapy and surgery mutually support and enhance each other.

Intestinal Tuberculosis

Similar conditions prevail also in intestinal tuberculosis. Here, too, we endeavor, when a radical operation like circular excision cannot be done, to relieve the tuberculous bowel by auxiliary operations, enteroanostomosis or incomplete intestinal exclusion, removal of stenosis, and to create favorable conditions for definite healing. We can say with Ambroise Paré: "*Je l'ai opéré, Dieu le guéira*" (I have operated on him, God healed him). Too long in surgical tuberculosis the local condition was receiving attention while the treatment of the patients was not sufficiently considered. We must not forget that tuberculosis is a general disease, and that it almost never establishes itself primarily in bones or joints, but that the latter are infected in children from primary foci in the lymph glands, especially those of the hilus and mesentery, and in adults from the same source or from the lung. Accordingly we never can assert neither after a radical removal of a focus in the bone nor after an arthrectomy or resection, nay not even after an amputation that the con-

cerned individual has been surely healed.

I have collected all my cases of surgical tuberculosis since 1886 and studied them critically. My former assistant, Dr. Ernst Wöllflin, now Professor of Ophthalmology in Basel, has worked up 302 cases that were observed until 1899 and has published his findings in his Basel dissertation: "*The Influence of High Mountains on Surgical Tuberculosis.*" *Wöllflin's dissertation is the first document on a methodic employment of high mountain treatment of surgical tuberculosis.*

The general treatment of these patients with grave cases was identical with that employed in pulmonary cases; namely, energetic free-air — rest cure, combined with extensive properly selected nutritive diet. Milder cases, especially patients who had no osseous lesions, I allowed to become hardened by participating in sports in the free air.

The favorable factors of high mountain climate should be used extensively by the patients. The longest possible stay in the open and exposure to the sun, systematic hardening, strengthening, fat-rich foods — these are the cardinal points of climatodietetic therapy.

At the Ninth Congress of the Swiss Physicians Society, in Olten, on November 3, 1900, during which O. Hildebrand, then Professor in Basel, opened a discussion on "*The Treatment of Articular Tuberculosis,*" I was in a position to submit among others the following report on the high mountain treatment of surgical tuberculosis:

My therapeutic measures are directed not only against the tuberculous focus but principally against the tuberculous man, and for this reason I place the main value on the climatodietetic therapy, in the surgical tuberculous as in consumptives. The patients should remain as long as possible in the open and exposed to the sun.

Properly speaking I was then unconsciously practicing radiotherapy in addition to free-air cure. We know today from the experiments by Bowles and others that the clothing we are using is not at all impermeable to strong and especially to chemical light. How often do we observe in light sensitive men the appearance of freckles in bodily regions covered by clothing. Thus in strong illumination we are subject to the influence of the sun rays even under our clothing. Day and night the living and sleeping rooms should be well ventilated. Patients who are not hindered by their illness, such as glandular or skin tuberculosis, should take exercise according to their strength, and participate in sports also in winter time, which, however, must be controlled by the physician in each individual case. By these measures the patients become hardened, their organism becoming animated and

strengthened. Great weight is placed on good nutrition. Surgical intervention becomes less necessary by this supportive treatment, but where it becomes necessary it is better tolerated.

With the aid of the climatic advantages of Engadin, I have obtained excellent cures in about half of 50 cases of articular tuberculosis especially of children, by conservative treatment (Bier's venous congestion, iodoform oil injections, orthopedic measures, occasionally minor, atypical operative procedures). The functional result of a conservatively treated joint is usually better than one that has been resected. Thus of two young patients with tuberculous inflammation of the elbow, who had been referred to me for a cure in the high mountains, both were cured without an operation and later were found fit for military duty. A sixteen-year-old Italian with a poor family history, suffering from a tuberculous inflammation of the ankle joint, was cured by free-air, rest cure, supported by iodoform injections with a slight thickening of the joint, and four years later participated throughout the entire Abyssinian campaign.

My efforts have not been in vain, for they found many echoes, and soon many children with scrofula and diseases of bones found cures in the high mountains. Later came the time when I added to the free-air treatment the energetic rays of the Alpine sun as an important therapeutic factor.

As early as 1899, in Wöllflin's dissertation the great value of the stronger insolation in the high mountains was greatly evaluated. In the chapter entitled, "Skin" it was then said:

It is striking that we encounter so few cases of lupus, although it is especially prevalent in the country. It would at any rate be interesting more precisely to examine the influence of insolation in high mountains on the etiology and healing process of lupus. According to the experiments of Violle the weakening of the sun rays at the height of Mont Blanc accounts to only 6 per cent while at the sea level it amounts to 20-30 per cent. Until today, so far as I know, there are no labors on this subject. It would be in accord with this view to accept that bacteria, and especially the tubercle bacilli perish when they are exposed to sun light for a long time.

As I had supposed, 12 years later A. Treskinskaya has established by parallel experiments in Davos (1500 meters above sea level), in Wald, Canton Zurich, (624 meters above sea level) and in St. Petersburg, that the bactericidal effect of sunlight on tuberculosis increases according to greater height. I would also mention the experiment by Jessionek, who spread on his arm a highly virulent pure culture of tubercle bacilli, and after exposing it for half an hour to the direct rays of the Spring sun, proved that the bacilli were killed and inoculations failed.

Though I thought of sunlight therapy on account of the observation with lupus, it required a few years, during which, by the way, I saw no more lupus, until an occurrence forced me to undertake practical efforts.

Sunlight and Infected Wounds

On February 2, 1902, in the night I received an Italian patient in the hospital at Samaden (1720 meters above sea level) who was gravely injured by seven knife wounds. Among others he had two perforating chest and two perforating abdominal wounds with injury to the liver and spleen. I was compelled to remove the cut spleen on account of dangerous hemorrhage. Eight days after the laparotomy the operative wound burst wide open throughout its length — only the peritoneal sutures holding. Attempt at closure by secondary suture failed, it being impossible to adapt the wound margins. The wound was tamponaded with iodoform gauze, and after being narrowed by adhesive straps was let alone. Gradually the large wound began to granulate, but the granulation tissue was spongy and flabby, and the wound suppurated extensively. All powders used to dry out the wound proved useless. Silver nitrate and curettage were frequently employed, also without avail. When on a magnificent day I came to the hospital and the sun rays warmly came through the open windows and fresh, stimulating air penetrated the entire sick room, I suddenly had the idea to expose the large wound to the sun and air, for the mountain worker of the Bund has for ages exposed fresh pieces of meat to the dry air and sun and conserved them as nutritive and tasty food. I decided to try the antiseptic and desiccating effect of sun and air also on living tissue. To the great surprise of the personnel I ordered his bed to be removed to the open window and exposed the large wound. After the first radiation of one and one-half hours there was noticeable a great improvement, the wound presenting an entirely changed picture. The granulations became noticeably more normal and stronger, and the enormous wound became covered by skin under this treatment.

This success caused me to treat intensively all granulating and infected wounds with sun rays. To the wounds were added fistulae, tuberculous ulcers, and, basing on the splendid results in the latter, we added also closed surgical tuberculosis. Here, too, the results were

excellent. It was precisely in surgical tuberculosis that heliotherapy was fated to become the method of choice. For the sunlight treatment my mountainous country offered very favorable conditions. In the first place the mountain sun is characterized by an increased intensity of the light in its three peculiarities — warmth, light, and chemical force, especially by the rich content in violet and ultraviolet rays. In the second place the country enjoys longer sunshine than elsewhere. Furthermore the intensity of insolation depends considerably on the angle of the rays, which is favorable for the mountains slanting to the South. The sunlight therapy is also facilitated by the decrease of the warm air which runs parallel with the height, so that the disadvantages of too strong heating in consequence of the surrounding hot air are absent, permitting corresponding longer exposures.

When Finsen introduced his epochal light treatment of lupus, he also thought of such advantages, and wrote:

"One can see that when one has to deal with the erection of a large institution for the treatment of lupus or of a sanatorium for lupus patients, especially in southern regions, it would be purposive to place them in high localities. Apart from the economic importance which the application of sunlight has as compared with electric light, there is the advantage that in such a locality one could attain favorable results from the great chemical intensity of the light entirely different than is possible by sunlight in our country."

Finsen's prophecy has proved itself correct in relation to the therapy of tuberculosis in a wide sense.

Sunlight and Mountain Regions

Whenever possible, therefore, mountainous regions should be selected for light therapeutic purposes. Wherever serious difficulties present themselves, the sea coast should be the first consideration in low lands. Oceanic, insular, and coastal climates have for a long time played an important rôle in the treatment of surgical tuberculosis, this doubtless being due to the salt content of the air and partly to the greater illumination produced by the reflection of daylight from the endless water surface. Next to the high mountains sea climate is the one preferable for heliotherapy.

The results obtained by sunlight treatment even in lowlands must give joy in the heart of every heliotherapist. Nevertheless, we must not forget that the sunlight treatment in a lowland is greatly limited both with re-

gard to duration and intensity, especially in the hyperboreal zones. As with medication quality and quantity of drugs must be considered, so also with light.

Since 1902, I have persistently developed the sunlight treatment and have become a greater and greater enthusiast for the method. My first trials with it I have carried out, as already related, when I was a specialist in the Upper Engadin Circuit Hospital (Oberengadiner Kreisspital) in Samaden, and I have continued this practice after my removal to St. Moritz in my private surgical clinic in that city.

On the basis of my publication and encouraged by my surprising results obtained with this method in Engadin, Rollier, in Leyzin, (1300-1450 meters above sea level) two years later opened clinics for the exclusive treatment of surgical tuberculosis with heliotherapy. He has developed this method on a large scale and earned merit by his own numerous publications as well as those of his pupils and coworkers.

The successes which had been good ones with climatotherapy became greater ones by the addition of direct insolation. By comparing the results of the period "Free Air Cure" with the success of the second period "Free Air Cure and Direct Sun Radiation," the finding speaks clearly for the great therapeutic value of direct insolation, in that by it the time of cure is shortened, and operations have become restricted even in apparently hopeless cases.

Alpine sun and Alpine climate combined today present the best remedy at our disposal for our largest scourge of the people, tuberculosis, both that of the lungs and of the surgical type.

The striking and often wonderful results obtained with heliotherapy in the high mountains, have excited the attention of the medical world and contributed to its development, so that one may properly say that heliotherapy has descended from the mountains to the valley and from there began its march of victory. It has also given the impetus to an intensive, scientific research of the physical and biological properties of light.

Science especially aimed to discover artificial sources of light which would come close to the intense sunlight of the high mountains. Physical therapy today commands a whole series of such lamps of radiation. Principally

Hanauer's quartz lamp, the so-called "artificial Alpine sun," thanks also to an intensive advertising propaganda has found employment in hospitals, sanatoria, etc., as a partial substitute for natural sunlight.

Lately we owe to technical science a special glass, Uviol or Vita glass, which aims at producing full effects of ultraviolet rays also in closed living rooms.

My experiences with the treatment of surgical tuberculosis are based today on nearly 2,500 cases, which concern the entire range:

1. Tuberculosis of the skin.
2. Tuberculosis of tendons and bursae.
3. Tuberculosis of the lymph glands.
4. Tuberculosis of bones and joints.
5. Genitourinary tuberculosis.
6. Tuberculosis of the serous membranes (pleuritis and peritonitis) and Poncet's rheumatism.
7. Intestinal tuberculosis.
8. Tuberculosis of the organs of senses.
9. Multiple localizations.

Of my first 1,000 cases of surgical tuberculosis treated with heliotherapy, 858 were cured, 120 were improved, 14 were unimproved, 8 died (0.8 per cent). Of the unimproved cases 6 died later from their tuberculosis. Mortality, including late deaths (14), shows about 1.5 per cent. Rollier's statistics give similar results.

It would lead us too far to discuss in an article the heliotherapy of all tuberculous localizations, and I will briefly discuss tuberculosis of the lymph glands, of the bones, articulations and serous membranes, pleuritis and peritonitis, and of the multiple tuberculous localizations.

Tuberculosis of the Lymph Glands

Tuberculous lymphoma is favorably influenced by heliotherapy in all stages, the purely hyperplastic form, hyperplasia, formation of nodules, and caseation, including the formation of abscesses with or without extension to the surrounding tissue and in secondary supuration resulting from a mixed infection by pyogenic cocci.

In the first stage — simple hyperplasia — radiation is advantageous because it influences the smallest glands which in operations often escape the eye and hand of the surgeon. Insolation stimulates fibrous shrinking and leads to destruction of the tubercle; caseous foci, when not too large, become encapsulated by

connective tissue granulation and are thereby rendered harmless, or go on to calcification. This is a great advance over the operative results, not only in an esthetic sense in saving the patient from the often ugly and disfiguring scars in the face and neck, but we are useful to them also in a social sense since such scars bear the stamp of tuberculosis even after a complete cure. Mention must also be made of the frequent recurrences after operations, which under heliotherapy are counted as exceptions.

Hilus glands also react very favorably to sunlight treatment, roentgenography and fluoroscopy having made possible the certain diagnosis of this previously occult disease, and which now was proved to be a very widespread one. More and more such patients are being referred to me and I have already treated about 500 cases. The results are throughout good ones — shrinking or calcification. Periodic roentgen examinations facilitate control of the progress. Likewise I have obtained complete cures in patients who had become completely run down by tuberculosis of the mesenteric glands, which were palpable through the abdominal wall, often a few months sufficing so to change the patients for the better that they could not be recognized.

Tuberculosis of Bones and Joints

We see the dissolving and subsequent desiccating fibrous shrinking effect on lymphomas also in tuberculous joints, irrespective whether the synovial or bony processes predominate, and in many cases we obtain full normal restoration of function.

We see the most beautiful results in tuberculosis of bones in that the tuberculous tissue is not only replaced by tough connective tissue scar, as we see it in lungs, glands, etc., but as a rule after healing of the tuberculous process we note complete anatomic and physiologic restitution in the form of regeneration of bone. Sunlight here appears to be a stimulating agent, which produces strong granulation tissue, in which a more or less pronounced formation of bone takes place. Such a regeneration of bone affects not only small bones, like the phalangeal, metatarsal, and metacarpal bones, but we observe it also in the long bones, both in the diaphysis and epiphysis, and in juvenile persons we often have seen even large articular heads which appar-

ently have been completely destroyed by the tubercular process, regenerate and become cured with the attainment of a normal shape, e. g., the femoral head.

This also explains the accompanying healing of the capsule and ligaments with normal function. The process of regeneration of bone can be observed by periodic x-ray examination.

I have gained the conviction that almost all cases of tuberculous osteitis can be cured by sunlight, when one commands the necessary means, time and patience.

Mention must be made that precisely those forms of tuberculous joint and bone disease, which have been the crux of surgeons, the best skilled of whom obtained most unsatisfactory results, are cured completely by sunlight, and recurrences are seldom seen. In this regard I mention spondylitis, tuberculosis of the pelvis, ileosacral disease, and coxitis. In tuberculous spondylitis the earlier mortality has been about 30 per cent, while in coxitis the mortality even in the hands of the best surgeons was 48 per cent. And what was ordinarily the fate of the so-called cured ones? The spondylitics dragged themselves as poor cripples with ugly deformities of the trunk, atrophied extremities, suffering from palpitation of the heart, shortness of breath, chronic catarrh of the lungs, digestive disturbances as a result of dislocation or affection of the minor organs, depressed through the sense of knowing themselves to be ugly and abnormal, often also avoided or neglected by cruel fellow beings. How many patients have we seen after having been operated for tuberculous coxitis hobble on crutches with pes equinovarus position, often with shortening of the leg even beyond 20 centimeters, tortured and deformed by a bad lumbar lordosis! Many difficult obstetrical cases were due to resected hip joints, in which large parts of the pelvis have also been radically removed; How different is it today! Thanks to climato- and heliotherapy, combined with suitable orthopedic measures, almost all of these patients become cured either completely or with very mild deformities, and regain their full value as human beings.

Tuberculosis of Serous Membranes

In more than 200 cases of serous pleuritis which had been referred to me for delayed resorption, I have always seen a favorable effect of radiation on the resorption of old

exudates and scars. I saw favorable results also in tuberculous empyema, the curative process of which can be nicely followed by periodic x-ray examinations. Now and then I employ in serous pleuritis aspiration as an aid, lately very rarely because it has been found that the tubercular exudate carries antigens which favor spontaneous healing. One should restrict one's self to late aspiration, unless the dislocation of neighboring organs by the exudate requires relief.

Tuberculous peritonitis represents a grateful field for heliotherapy. In more than 70 cases of tuberculous, serous peritonitis I obtained almost exclusively complete cures, one case complicated by pulmonary tuberculosis, dying. Previously a much dreaded localization, which often led to meningitis or miliary tuberculosis, tuberculous peritonitis has lost much of its terror since the use of climato-dietetic and sunlight treatment. The cure is a lasting one. Several of my patients whom I have treated when they were girls for grave tuberculous peritonitis, have married and are today mothers of healthy children, a few even grandmothers with healthy grandchildren.

In the suppurative ulcerative form of peritonitis with multiple matting of omentum and loops of bowel, even with multiple abscesses, one often obtains with radiation beautiful results, while with a radical operative procedure usually one does more harm than good, fecal fistulae and intestinal prolapse only too often being the undesired results of operation.

Multiple Tuberculosis Localizations

In multiple surgical tuberculosis and in cases of repeated recurrences after operation, in which the surgeon must ask himself where to begin and where to end, or where he is about as helpless as in recurrences after operations for cancer, heliotherapy occasionally has a truly miraculous effect. Where before these unfortunates became disgusting to themselves and to their surroundings by the years of profuse suppurations, they slowly and miserably perished from general exhaustion or amyloid degeneration, if a miliary tuberculosis had not pitifully ended their suffering.

It is generally the great success of helio- and light therapy that operative activity in surgical tuberculosis has experienced an enormous restriction, and that better general, functional and cosmetic results are obtained than

before. It is not only the mortality that has been greatly reduced, but indefinitely more patients now get well with useful extremities than with the previous method of radical surgical treatment.

We may say with justified pride: We see today much fewer cripples. A straight spinal column and useful extremities mean a greater human and social value of the cured patients. The greatest physician of all times, Hippocrates, has 2500 years ago given the dictum often cited in latin: *Quos medicina non sanat, ferrum sanat, quos ferrum non sanat, ignis sanat, quos ignis non sanat, ii jam nullo modo sanandi sunt.*" ("What medicine cannot cure,

iron can, what iron cannot cure, fire can, what fire does not cure, no method can.")

This sentence does no longer fully apply to surgical tuberculosis. In its treatment the knife and the actual cautery play only a secondary rôle. Instead of this crude curative method we have mild light, sunlight, and especially that not weakened, thanks to the pure atmosphere of high mountains, which animates, builds up, not *cito* (quickly) but *tuto* (entirely) *et jucunde* (and pleasantly), in a manner which to this day no human art has been able to accomplish. Natural as well as artificial light has become the salvation of the large army of sufferers from surgical tuberculosis.

TRANSURETHRAL SURGERY — ITS INDICATIONS AND LIMITATIONS *

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It would be a difficult task for one to prescribe a well-defined, unimpeachable method of attacking the obstructing prostate, since individual preference and the personal equation register potent qualifications. There are surgeons who still believe that practically all prostatic obstructions should be removed by open operation, others who insist that transurethral surgery is capable of effectively relieving all such obstructions, and many others who concede certain prostates of larger dimensions to open surgery, relegating the majority to transurethral methods.

There can be no question that either the open or closed procedures can remove practically all prostatic obstructions, and it appears to me, after many years of concentration upon this important subject, that it is simply a question of balancing accounts of the results secured and the mortality rate experienced in the hands of surgeons who can competently do both. In order for transurethral surgery to supplant major procedures, it must be demonstrated to be effective in completely removing the obstruction without the hazards, complications, and high mortality rate which attend open prostatic surgery. This I feel has

been amply proven in the last few years of transurethral surgery. Over 12 years ago I appreciated the efficient value of my cautery punch operation in completely relieving many of the larger prostatic obstructions. In the early days I applied this method to about 25 per cent of all obstructions, and during the course of the ensuing five or six years I gradually increased its use to about 75 per cent. During 1930 and 1931 a prostatectomy became a rare performance. I repeatedly reported the results of these transurethral operations by means of my cautery punch and showed in numerous series of cases, finally aggregating almost 900, that this method competently and safely relieved the obstruction in over 80 per cent of all cases, and many of the remaining incomplete results were due to failure on the part of the patient to follow through with the plan which had been designed, namely, repeat operations.

I observed at the very outset of partial prostatic removal in many of the larger growths, that a pronounced retrogression and absorption of the remaining gland took place. In some instances to an astounding proportion, in others not so pronounced. It was for this reason coupled with numerous other equally definite observations which I have repeatedly

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 14, 1933.

described and reported that I was assured of the inflammatory nature of these growths, contrary to the generally conceived neoplastic theory. I am still confident that this is the fundamental factor in transurethral surgery. The tendency to resolve under drainage urges us to allow nature to aid the surgeon in these procedures and not to subject the patients to too extensive manipulations at any one time. This is a most important phase of transurethral surgery, and if deviated from is likely to hamper its perpetuation. There can be no question that prolonged instrumentation with the creation of raw surfaces in a previously infected urethra and bladder and in an individual whose upper urinary tract is none too stable, is to be most vehemently condemned, if we are to expect transurethral surgery to live.

My insistence for many years of the value of transurethral surgery was not heeded until recently, and during the last three years this method of attacking prostatic obstruction has become almost universally adopted, so that at the present day most urologists are agreed that transurethral surgery is adaptable for the relief of the majority of obstructing prostates. It has been proved that it is mechanically possible to completely relieve the obstruction, and that such technic should supplant open surgery in the majority of instances.

Methods of Transurethral Surgery

There are at the present time numerous methods of transurethral surgery. Many operators have proposed instruments for the correction of the disease, and it appears to be our chief mission at the present time to determine the safest and most effective of these procedures. Naturally, being interested in the proper outcome of transurethral surgery, I have felt a sincere desire to understand definitely the physical properties of the various methods in vogue, and to determine their specific effects, not only with regard to their ability to remove obstruction, but their influence upon surrounding structures. For this reason, during the past year, with the assistance of Mr. Wilbur Harris of the Department of Physics, I have made a comparative study of the different therapeutic agents currently used for such operations, and have furthermore fortified these experimental observations with practical clinical studies of over 15,000 cases done by different operators using vari-

ous methods. The outcome of these experiments and observations I wish to present to you on this occasion.

After many years experience with the cautery punch during which time I have performed about 900 operations, urinary sepsis has been an occasional sequel, secondary hemorrhage extraordinarily rare, and other serious complications such as incontinence, urinary extravasation and rectourethral fistulae were practically unheard of. The general mortality rate was below one per cent, even including all of the serious risks.

In gathering reports from those who were performing electrical resections with the several types of cutting currents I received information from various sources that such complications were quite common in spite of the fact that the operation had apparently gone well. The surgeons who had noted these complications usually were unable to explain their cause. The universal remark was that the cutting was clean and bloodless at the time of operation, and they could offer no reasonable explanation for these untoward occurrences.

Realizing that the high frequency currents commonly employed are biterminal currents and that the heat waves are passing between the two electrodes, the indifferent and the active, and concentrating at the latter, it occurred to me that possibly, in so doing, there was produced deep in tissue away from the actual operative field, an amount of heat entirely incompatible with the life of the adjacent structures, whereas in the cautery, the heat was generated only at the point of actual burning and penetrated tissue only through conduction, at a depth that was problematical. In order to verify these impressions, Mr. Wilbur Harris working with me, measured the amount of heat produced in different depths of tissue with different current values and variable time exposures with the several types of high frequency machines which are ordinarily employed, and also made similar observations of the effects of actual cautery applications under identical circumstances. These experiments were conducted on experimental media, animal and human tissue. The data were accurately determined by means of thermocouple-galvanometer registrations. (Fig. 1.)

The results of these experiments, which have been previously reported in detail, are

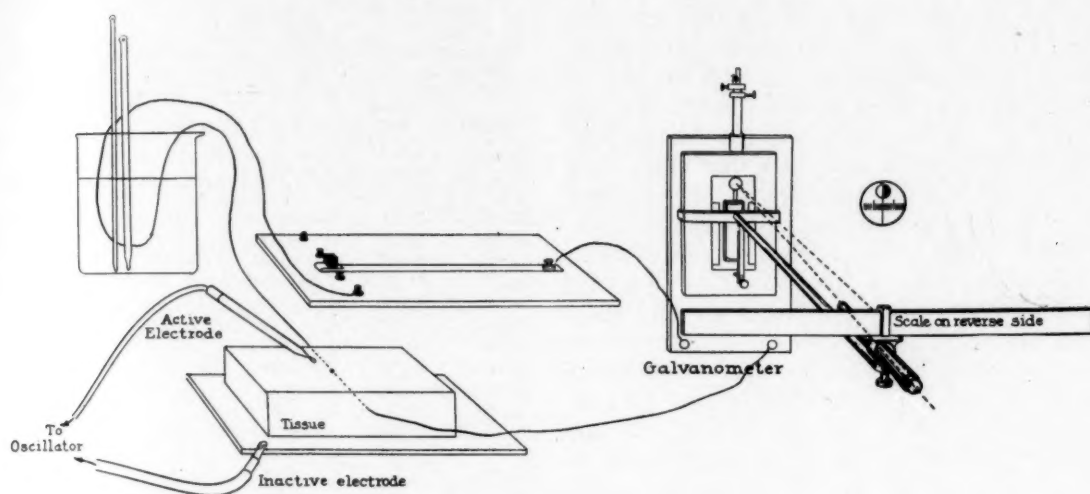


Fig. 1. Thermocouple-galvanometer arrangement to measure the depth of heat production by cautery and high frequency apparatus.

briefly illustrated in the following tables. The experiments were performed on a homogeneous conducting medium composed of gelatin containing 0.95 grams of sodium chloride per liter. Blocks of gelatin were placed on a sheet of tin which served as an indifferent electrode, while the active electrode was applied to the upper surface of the block. The temperature measuring device consisted of the well known thermocouple-galvanometer combination. The couples used were made of two segments of iron wire with a segment of constantin wire interposed. This combination gave about 50 microvolts per degree difference in temperature between the junctions, which was sufficient to give full scale deflection on the galvanometer (sensitivity 6×10^{-8} amp. per div.) for 11 degrees centigrade difference in temperature between the junctions. In actual use the sensitivity was adjusted by using resistances in series and as shunts. It is advisable to use a shunt for the sake of galvanometer damping unless the instrument is already highly damped. The thermocouple junction that was to be placed at a point whose temperature fluctuations were to be measured, was the point of a bakelite needle which incised the iron and constantin leads. This needle was about 15 centimeters in length and 1.5 millimeters in diameter.

In Table 1, S^1 and S^2 represent primary and secondary readings of the galvanometer following 3 seconds application of 900 milli-

TABLE 1
Temperatures Produced in Gelatin With the High Frequency Current

S^1	S^2	Temp. Change	Time	Distance from Cutting Loop to Thermocouple	Current Value
8	28	1.21 C.	3"	1.5 cm.	900 ma.
	34	1.69			
	38	1.94			
	53.5	2.84			
	59.5	3.35			
	68.8	3.95			
	75	4.36			
	86	4.94			
	91.8	5.47			
	99.2	5.92			
	105	6.31			
	113.5	6.87			
	122.8	7.48			
	127	7.74			
	134	8.10			
	139.8	8.58			
	145	8.92			

TABLE 2
Comparative Temperature Changes of High Frequency and Thermal Cautery in Gelatin

Time	Distance	Temperature Change °C.	
		High Frequency	Thermal Cautery
3"	.8 cm.	3.21	0
		5.70	0
		7.80	0
		8.65	0
		10.10	0
		11.17	.001
		13.20	.003
			.120
			.214
			.354
			.502
			.708
			.915
			1.158

ampere current value with the thermocouple placed 1.5 cm. away from the site of burning. Water was copiously flowing over the site of application and a 10 second interval was allowed for cooling time between the applications. It is to be observed that there is a gradual rise of temperature at this distance from the site of burning, up to almost 9 degrees C. following 17 applications of current.

Table 2 shows a comparison of temperature changes with high frequency and thermal cautery. Three minute applications of current at 0.8 cm. away, 500 ma. current value gave a rise of 13 degrees following 7 applications of the electric current, whereas with the cautery it required six similar applications to reach .001 degrees, and 14 applications were necessary to increase the temperature one degree. This table admirably demonstrates the penetrating heat effects of electricity and the negligible rise of temperature resulting from cautery application.

TABLE 3
Comparative Temperature Changes of High Frequency and Thermal Cautery in Gelatin

Time	Distance	Temperature Change °C.	
		High Frequency	Thermal Cautery
3"	0.4 cm.	8.67	0
		19.15	0
			0
			.189
			.610
			1.464
			1.953
			2.440
			2.930

Table 3 again shows the comparative temperature changes of the high frequency and cautery in gelatin at 0.4 cm. away and reveals that after two applications of three seconds each with the high frequency current a temperature of 19 degrees was produced and that it required 9 similar applications of the cautery to increase the temperature 2 degrees at this distance.

Similar experiments were conducted in beef heart, muscle, and glandular tissue in different animals and the same comparative effects were noted, therefore for the sake of brevity these tables will be omitted.

Numerous experimental studies were made on the human prostate. A number of typical transurethral resections with high frequency were done and the registrations of temperatures recorded by means of the thermocouple which was placed through the perineum into the prostate in a manner similar to the implantation of radon seeds.

TABLE 4
Temperatures Produced in a Transurethral Prostatic Resection Employing High Frequency Currents

Temperature Before Cut	Temperature Immediately After Stroke	Duration of Cutting Stroke	Current Value	Note
37.6°C.	40.4°C.	5"	900 ma.	
37.70	40.53	8	800	4 min. pause.
37.73	41.37	6	700	
37.70	40.08	12	700	Cutting high.
38.01	41.37	7	800	
38.60	42.13	9	700	
38.64	41.08	8	800	
38.70	40.57	10	800	
38.70	40.58	8	800	
38.60	41.78	8	800	
38.30	41.06	8	750	
38.31	41.08	7	850	On lateral lobes.
38.37	39.88	9	800	
38.31	65.73	5	800	Cutting near median portion.
38.32	40.34	7	850	
38.14	41.88	6	900	Laterals again.
38.14	51.23	7	850	Median incision.

Table 4 is an example of one of these operations performed for a generalized intravesical hypertrophy. The table speaks for itself and shows slight rise of temperature following different current values and stroke applications, but it is to be noted that these applications register but little when the cutting is being performed on the lateral lobes, but when the current is applied to the median portion of the gland in the path of the thermocouple, as in the fourth line from the bottom and the bottom line, pronounced rise in the temperature is created. In the fourth from the last

TABLE 5
Temperatures Produced in Transurethral Prostatic Resection by High Frequency Currents

Temperature Change Produced by Stroke	Time of Stroke	Current Employed	Location of Thermocouple and Notes
2.65 C.	10"	575 ma.	In prostate above cutting.
1.70	5	600	In prostate above cutting.
7.72	9	575	In rectum as near as possible to prostate.
7.08	7.5	610	In rectum as near as possible to prostate.
8.31	7.5	610	In rectum as near as possible to prostate.
0.36	8	550	
1.51	40 sec.		after above stroke by conduction.
0.63	4	200 (coagulation).	
	40 sec.		after above application by conduction.
1.14	5	575	In rectum.
1.25	7	575	In rectum.
3.44	5	650	In med. lobe, cutting at 4 o'clock.
2.58	2	200 (coag.)	In med. lobe, coag. at 4 o'clock.
10.30	7	600	In med. lobe, cutting at 6 o'clock.
1.20	9	600	In lat. lobe, cutting at 3 o'clock.

line a temperature of nearly 66 degrees C., one well beyond the thermal death point of cells, is created, and it is reasonable to assume that these same temperature elevations were produced in the other portions of the gland in the area of burning, but that they were out of the line of the thermocouple registration and were simply temperatures produced by conductivity.

The instrument went off scale in a subsequent cut which removed tissue from near the thermocouple tip. This indicated a temperature rise of more than 40.2° C.

In Table 5 which is made up of three different operations, the same rise of temperature is observed but there are some interesting notations. In part one, the thermocouple was placed into the rectum and a rise of nearly 8 degrees was noticed with the same current value. This has been observed on numerous occasions and explains some of the rectal complications following the high frequency current. In referring to this particular and important point we noted on numerous experimental animals that if the rectum is crushed or injured and electrolytic fluids allowed to accumulate, the heat waves concentrate at this point regardless of where the electrodes are placed. Hence the importance of thorough rectal examinations and the correction of lesions such as fissures, or infected hemorrhoids before any such operation is employed.

It is to be noted both in part two and three, that with the coagulation current the rise of temperature is much less manifest and obeys the laws of physics that the coagulation cur-

rent of one-third the value of the cutting which is usually employed is productive of but one-ninth the heat. In other words, while the coagulation currents produce a superficial lesion which appears destructive to the eye in contradistinction to the cutting current which does not, it is much less likely to produce deep tissue damage.

Table 6 is an exhibit of the records obtained from two different cautery punch operations. The table is self-explanatory, and demonstrates that the heat produced with the cautery is negligible.

Several experiments were performed on the prostate through the open bladder where accurate placing of the thermocouple could be made. In each instance the site of operation was flooded with water at room temperature to aid in cooling, and Table 7 shows the high temperatures that have been recorded at the different distances.

TABLE 7

Temperatures Produced in a Human Prostate by Applying Cutting Currents from a 4 mm. Coagulating Ball in an Operation Preliminary to Prostatectomy

Temperature Before Application	Temp. Immediately After	Duration of Application	Current Applied	Notes
37.40° C.	46.02° C.	2"	700	Water running, suction functioning.
38.00	45.26	2	700	Thermocouple approx. 2 cm. from point of application of current.
38.72	47.25	2	700	
38.96	49.20	3	700	
38.96	46.56	3	600	Interval between applications about 2 min. except in two cases where it was longer.
39.20	45.74	4	500	
38.28	45.90	3	600	
38.36	47.55	4	500	
38.54	49.66	6	500	
37.4	42.1	1	1100	In rectum.
42.1	43.2	1	1100	In rectum.
39.3	63.0	1.5	1100	In prostate 1 cm. from application.
40.2	51.9	1	700	In prostate 1 cm. from application.
41.7	41.9	?	700	
41.3	50.5	?	700	

TABLE 6

Temperatures in the Human Prostate Produced in a Transurethral Operation Employing the Cautery "Punch"

Temperature Before Cut	Temperature After Cut	Time Employed	Notes
37.50° C.	37.50° C.	3"	Two minutes between cuts.
37.59	37.59	3	
37.83	37.83	2.5	

Four other cuts were made in this operation, but data could not be obtained. Data below is for a different case.

37.62	37.62	3	Temp. in ½ min., 39.06; 1 min., 37.98.
37.62	38.22	3	
37.87	37.87	4.5	Temp. in ½ min., 38.26.
39.06	39.06	4	Max. reached, 39.18.

These experiments demonstrate conclusively that the high frequency currents regardless of the machine — since all types of machines were used and all produced identically the same results — produce in the prostate at distances remote from the point of burning, temperatures entirely incompatible with the life of tissue. Numerous pathological specimens were removed which showed zones of necrosis reaching far beyond the superficial area of burning and at times extending to extreme depths. This is particularly true if

the specimens are observed from four days to two weeks after the burning. This point is sometimes misinterpreted, since the deep tissues may show no definite immediate destructive changes until the cells have had a chance to die. This accurately tallies with the effects we note in clinical cases, such as late hemorrhages and late sloughing. These distant destructive changes are the factors responsible for the late sloughing, secondary hemorrhages, urinary extravasation, rectourethral fistulae, and incontinence of urine. The later complications of high frequency resection have often been thought to result from mechanical injury of the sphincter by excessive removal of tissue, but these experiments demonstrate to me conclusively that they re-

sult from devitalization of the sphincter muscle from the heat effects. It is also to be observed that the coagulation current is less destructive to deep tissue than the cutting current, so that such complications should seldom occur. The cautery current is not attended by deep destructive change but is entirely a superficial process, hence late and distant destructive changes should not be expected.

Effects of Different Transurethral Procedures

It seemed highly essential to compare the immediate and remote effects of the different transurethral procedures as they occurred in the practice of numerous operators. Questionnaires were sent to members of the American

TABLE 8
Comparison of the Complications Resulting from Various Punch Operations and High Frequency Resections

Total number of punches.....	7,415	Total number of resections.....	8,073
159 Operators —		196 Operators—only 7,763 cases had	
Total hemorrhage	577-7.9%	definite data concerning hemor-	
Primary, mild	301	rhage —	
Primary, severe	112-1.5%	Total hemorrhage	817-10.1%
Cystotomy necessary	40	Primary, mild	272
Secondary, mild	126	Primary, severe	161- 2.1%
Secondary, severe	49-0.6%	of total.	
Cystotomy necessary	15	Cystotomy necessary	83
Total cystotomies required in 0.7% of		Secondary, mild	278
all cases —		Secondary, severe	106- 1.3%
Severe hemorrhages primary and sec-		Cystotomy necessary	36- 9.4%
ondary 2.1% of all and, 27.3% of		hemorrhage.	
all hemorrhages —		Total cystotomies required 1.7% of	
Rectourethral fistulae	0	all cases —	
Temporary incontinence	34	Severe hemorrhages, primary and sec-	
Permanent incontinence	1	ondary, 3.4% of all, and 32.0% of	
Urinary sepsis mentioned by 22.0% of		all hemorrhages.	
the operators, and as a cause of		Rectourethral fistulae	5
death in 20 cases, one-fourth as		Temporary incontinence	113
many as the resections.		Permanent incontinence	33
Extravasation	1	Urinary sepsis mentioned by 55.0% of	
Stricture of urethra.....	2	the operators, and as cause of	
Perivesical abscess	2	death in 91 cases, four times as	
Phlebitis	1	many as punches.	
Rupture of bladder.....	1	Extravasation	7
Peritonitis	2	Stricture of urethra.....	7
Mortality	-1.09%	Perivesical abscess	4
		Phlebitis	2
		Rupture of bladder.....	3
		Peritonitis	3
		Gangrene of bladder.....	4
		Rupture of diverticulum.....	1
		Perforation of bladder.....	2
		Ischi-rectal abscess	1
		Perineal abscess	1
		Trigonal injury	3
		Pelvic abscess	1
		Torn bladder neck.....	1
		Periurethral abscess	1
		Electrocution	1
		Mortality (Deaths 302).....	-3.74%

Urological Association to secure the type of operation they were employing, the number of cases operated upon, and the complications and mortality rate which followed the use of the different procedures. From these questionnaires, a statistical study of over 15,000 cases has been made. Of these 7,415 were done by the various punch technics, and 8,073 by the high frequency resection methods. The number of operators that employed the punch operations were 159, of the resection, 196, and of both, 141. The punch instruments most commonly employed have been the Young punch, the Caulk cautery punch, and the Braasch-Bumpus instrument. There were 2,770 cases operated upon by my instrument. Of the 8,053 high frequency resections, 5,560 were performed by the McCarthy instrument or one of its modifications, 855 by the Stern-Davis resectoscope, the remaining 1,688 by electrical technic not specified.

The following tables serve to forcibly illustrate the comparative effects of the different technics. A survey of these data elucidates the following points:

The incidence of postoperative hemorrhage following electrical resection exceeds that following the cautery at a ratio of 2:1, and the same proportion applies to the necessity of cystotomy to control the bleeding.

Urinary sepsis followed high frequency resection two and a half times as frequently as the punch technics, whereas the incidence of other serious complications, such as urinary incontinence, rupture of the bladder and urethra, rectourethral fistulae, peritonitis, etc., were encountered in 39 instances with the electrical resection and but 9 times with the cautery method. Rectourethral fistulae are tabulated in five instances (I know of many more) following electrical resection, whereas it has never occurred following any of the punch operations.

The mortality rate of the electrical methods is over three times as high as with the punch, and in the hands of the 141 operators who have used both methods the mortality rate is five times as great following resections.

Table 11 reveals the astounding fact that postoperative hemorrhage occurred much more frequently with the tube type of generator than the gap machine, and the incidence of temporary and permanent incontinence was over three to one.

Table 12 gives data compiled from 2,774

cases which have been operated upon by my cautery punch method. One is impressed with the relative infrequency of troublesome hemorrhage in this group, namely, 1.6 per cent and but 0.4 per cent of these cases required cystotomy to control the bleeding. Only 3.6 per cent of all these cases were marred by complications of any severity, and the mortality rate was 0.9 per cent.

The punch instruments, namely, the cold, the cautery, and the coagulation, are the safest and most effective in transurethrally removing the obstructing prostate, and the cautery punch appears to be the safest of the three. High frequency resections possess inherent dangers due chiefly to the production of destructive effects upon underlying tissues which must be properly appreciated, and while they cannot be completely controlled they must be meticulously regulated or materially modified, if they are to be continued as a means of prostatic removal.

TABLE 9

A Comparison of the Results Secured with the Punch and Resection by 141 Operators Using Both Methods

Punch	Resection
Number of cases, 6,008	Number of cases, 4,885
Primary hemorrhage 335- 5.5%	Primary hemorrhage 292- 6.0%
Primary, mild 251-75.5%	Primary, mild 147-50.0%
Primary, severe.. 84-25.0%	Primary, severe.. 145-50.0%
Primary cystotomy 33 or .5%	Primary cystotomy 65 or .13%
of total cases—10.0% of primary hemorrhages.	of total cases—22.0% of the primary hemorrhages.
Secondary hemorrhages .. 154-2.56%	Secondary hemorrhages 322- 6.5%
Secondary, mild.. 117-76.0%	Secondary, mild 237-74.0%
Secondary, severe 37-24.0%	Secondary, severe 83-26.0%
Secondary cystotomy 13 or .2%	Secondary cystotomy 33 or .7%
of total cases—8.4% of secondary hemorrhages.	of total cases—10.2% of secondary hemorrhages.
Of the total number of cases 0.6% had severe secondary hemorrhage.	Of the total number of cases 1.8% had severe secondary hemorrhage.
Mortality (Deaths 58), 0.9%.	Mortality (Deaths 231), 4.7%.

TABLE 10

Serious Complications Which Caused Death Aside From Ones Above Mentioned

Punch	Resection
Total punch deaths.... 81	Total resection deaths.....302
Sepsis 20	Sepsis 91
Embolus 1	Embolus 13
Apoplexy 2	Apoplexy 7
Cardiac 6	Cardiac 24
Shock 2	Shock 19
Septicemia 2	Septicemia 8
Pneumonia 13	Pneumonia 30
Uremia 3	Uremia 21

In comparing these two series it is noteworthy that embolism occurred almost ten times as frequently following electrical resection. Uremia resulted over five times as commonly following resection as it did with the punch operation, which unquestionably testifies to the laxity of proper preparation in many of the cases which have been operated upon by the resection method, and urgently signals the strict necessity for following the precepts of urology concerning preliminary preparation.

TABLE 11

Comparison of the Complications Resulting From the Two Types of Electrical High Frequency Resections

<i>Gap Machine</i>		<i>Tube Machine</i>	
106 Operators	3,296 cases	54 Operators	1,449 cases
Severe hemorrhage	90- 2.8%	Severe hemorrhage	97- 6.7%
Primary, severe..	52- 1.5%	Primary, severe..	67- 4.6%
Cystotomy necessary	24	Cystotomy necessary	30
Secondary, severe	38-1.15%	Secondary, severe	30- 2.0%
Cystotomy necessary	9	Cystotomy necessary	15
Total cystotomies required	- 1.0%	Total cystotomies required	- 3.0%
Rectal fistulae	3	Rectal fistulae	2
Temporary incontinence ..	48	Temporary incontinence ..	42
Permanent incontinence ..	13	Permanent incontinence ..	11
Sepsis	84- 2.5%	Sepsis	121- 8.3%

TABLE 12

Postoperative Complications of the Cautery Punch

Cautery punch cases.....	2,774
Total hemorrhage	189-6.8%
Primary, mild	121
Primary, severe	36-1.3%
Cystotomy necessary	10
Secondary, mild	24
Secondary, severe	8-0.28%
Cystotomy necessary	2
In other words only 1.6% had troublesome hemorrhage.	
Total cystotomies required in on'y 0.4% of these cases.	
Temporary incontinence	11
Permanent incontinence	1
Urinary sepsis	42-1.5%
Stricture of Urethra.....	1
Mortality	-0.9%

Technic

It must be thoroughly appreciated that transurethral surgery is not a simple process but a very delicate technical procedure, which requires the same careful preparation of the patient as for any operation, that the manipulations themselves must not be prolonged, the urethra must be spared from the injurious effects of long instrumentation, which alone is hazardous to any prostatic patient, and cer-

tainly when accompanied by the creation of a tremendous raw surface without adequate drainage. Unless urological surgeons promptly appreciate the urgent necessity for short operative sittings and the value of repeat operations, I fear that transurethral surgery will receive a tremendous reversal.

The postoperative care of these patients is of paramount importance. The absolute necessity of strict surveillance of drainage immediately after operation, the prevention of vesical retention through the occlusion of the catheter with clots, are the most important features of the postoperative course. The retention of vesical clots with stimulation of bladder contractions is responsible for subsequent serious hemorrhages. If the catheter is kept freely draining, I have seldom seen a serious hemorrhage. Where bleeding is a little more active than usual immediately after operation, the injection of 4 to 6 ounces of mineral oil into the bladder has a very beneficial hemostatic effect. In rare cases of active bleeding with the accumulation of clots in the bladder which will not evacuate through the catheter, the Bigelow evacuator should be immediately inserted in order to empty the bladder completely, and usually bleeding will cease. If the patient shows general evidences of hemorrhage, a transfusion should immediately be given. In nearly 900 cases I have in only one instance been compelled to open the bladder for an active, uncontrollable primary hemorrhage.

It is to be noted from the analysis of the cases that cystotomy has been required rather frequently to control hemorrhage. I really believe that if the operators had been more diligent in the postoperative care of the bleeding from its onset, the necessity for cystotomy would have been materially reduced.

In my series of cases, complications such as epididymitis, pyelonephritis, and urinary sepsis have occurred in about the same proportion one sees following the use of the indwelling catheter or any urethral manipulation. My mortality rate is around 1 per cent, and this is increased by the fact that three cases died while in the hospital being treated for other conditions, severe cardiac lesions, hypertension, cachexia. Death ensued from ten days to two weeks after operation without there having been the slightest complication following the punch operation. In other words, the surgery had no contributory in-

fluence to the death which was the result of original constitutional disease.

The functional results have been previously described on many occasions and have been shown to be entirely satisfactory in over 80 per cent, and would have been higher except for the lack of cooperation of some of the patients with larger obstructions.

Indications

I am firmly convinced that transurethral surgery should be employed in at least 80 per cent of all vesical neck obstructions, benign and malignant, and that it could be employed in practically all obstructions but for my firm belief in the necessity for repeat operations. In dealing with prostates of tremendous dimensions, I do not feel justified if the subjects are good surgical risks, in subjecting them to such a long course of corrective transurethral procedures, but feel that these glands should be surgically removed. In the poor surgical risks it should be our aim to give them a maximum result with a minimum sacrifice, and this I believe can only be done through repeated transurethral procedures over a long period of time.

The other definite indications for transurethral surgery are practically all cancers of the prostate, usually in conjunction with radium or deep x-ray therapy; polyps or congenital bands in the urethra; contractures of the neck in women and children, as a complication of vesical tuberculosis, and to close indolent suprapubic fistulae.

I am convinced that the punch operation of the cautery type, such as mine, or associated with coagulation, is far superior to any of the electrical devices which are employed at the present time.

In order to meet the demand for a visual instrument which will remove tissue with the highest degree of safety, I am presenting to you this morning a modification of the cautery punch which has been perfected by Dr. Evan Cackley and myself with the excellent engineering assistance of Kenneth Drucker of Phillips-Drucker of St. Louis.

Modification of Cautery Punch Instrument

It consists of an obturator, sheath, cord, and combination punch tube and telescope carrier. A standard McCarthy foroblique telescope is employed for vision and illumination, giving as perfect vision as can be expected.

The cautery cord is equipped with a ro-

tary contact so that it can be kept in the most convenient location at all times. A two-way waterflow is provided by means of specially constructed tubing used on the working element of this instrument. The tubing also carries the electrical current down to the blade and is insulated to prevent short circuiting. To farther describe this tube you will have to visualize a picture of two tubes cemented side by side with a shape through the center of them capable of carrying the telescope. Each tube is capable of supplying ample water for irrigation and still have room for a No. 6 Sparking Electrode, which is supplied with the instrument. To further explain the shape of the tubes a cross section or view looking down on the two assembled tubes would be that of a complete circle with a line drawn through its center. Then within the circle on the center line and against the outer edge another circle about one-third the diameter of the first one. This should give two sections of exactly the same shape. The smaller circle would represent the path of the telescope. The center line to the small circle and then to either side of it would represent the path of insulation between the two tubes.

The blade is mounted on two copper electrodes that become part of the distal end of the two conducting tubes. An improvement in the blade construction is the use of 20 per cent iridium platinum which is harder than the former blades, stands more heat and abuse, and holds an edge longer. The blade is tilted slightly backwards which by experimentation has proven to be the angle at which cutting is best.

The sheath is equipped with a quick acting locking device to lock the telescope carrier in place during the operation. This same lock also holds the obturator in place during insertion of the punch. There is also a chamber at the end of the sheath that contains gaskets to seal off water leakage. The fenestrum and the beak are similar in shape and size to the present model Caulk Punch.

Finger grips are provided on both punch and sheath tubes to allow better manipulation of the instrument.

The instrument with the obturator in place is inserted into the bladder, the working device released, and the obturator removed. The working element, consisting of the blade, irrigating channels, and telescope are inserted. On pressing down the beak of the instrument

irrigation is started and the bladder neck and surrounding tissue, such as the trigone and ureteral orifice, are visualized. The obstructing area is approached under perfect vision and the part to be removed is observed to fall into the slot of the instrument. The usual punch grip is applied and the tissue firmly squeezed into the slot of the instrument. The working element is then pressed forward by means of the thumb of the right hand being applied to the lever of the instrument, and the current is applied. The working element is then pushed forward until it goes home. This cutting process can be accurately observed throughout its extent, and is unhampered by bubbles which are so common with the electrical devices. The locking device is released with the thumb of the left hand and the working element removed from the sheath of the instrument. The specimen, which is larger than any of the specimens previously removed by any other method, is extracted from the blade. It is very rare for the tissue not to come away with the blade, since it usually adheres to it, owing to a special construction of the instrument. The size of the piece is larger because the lumen of the inner working device is not encroached upon, as in the previous instruments, by the cement which fortified the electrodes and supports. The working element is reinserted, irrigation

started, and another portion of the orifice is grasped and removed in the typical punch manner. This is accomplished by a firm grip forcibly squeezing the tissue to be removed in the slot of the instrument by carrying the outer part of the instrument in a direction opposite to that in which we are removing the tissue. This process may be applied to any part of the orifice and repeated as long as the operator sees fit.

I feel that one of the greatest safeguards in transurethral surgery is for the instrument to possess a slot in which the tissue may be accurately secured before its removal, thereby preventing the dangers of accidental injury of other structures, such as the urethra or trigone, which are not uncommon with instruments without a beak.

In the cases which have been operated upon by this new instrument, hemorrhage has been negligible, and, if at all noticeable, it has been stopped by resecting with the cautery blade under absolute visualization. There has never been a necessity for the insertion of the fulgurating electrode.

Owing to the special construction of the blade of the instrument, a long life seems insured. So far we have never had to replace one.

723 University Club Building.

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TRANSURETHRAL SURGERY: A REVIEW OF RECENT REPORTS AND SOME PERSONAL EXPERIENCES *

HARRY C. ROLNICK, M.D.

CHICAGO

During the past decade, our knowledge of the pathology of bladder neck obstructions in the male has increased considerably. Whereas, in the past, prostatic hypertrophy was the condition almost entirely thought of, we are now seeing and treating more median bars and contractures of the bladder neck. Because some form of excision of these bars or contractures is in-

dicated, various types of intraurethral instruments had been recommended and employed, although unsuccessfully, for almost a century.

Caulk's visual electrocautery punch was the first instrument that proved of value, and to him, more than any other man, is due the credit for much of the present day vogue of intraurethral electrosurgery.

With increasing experience, and the development of newer instruments, all blad-

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 14, 1933.

der neck obstructions, including prostatic hypertrophy, have been attacked intra-urethally. We now have reached the stage where this procedure has become routine, and where practically every urologist in this country, and many abroad, have had some experience with it.

There is already a considerable literature on this subject, the vast majority of which is favorable to this type of therapy.

Some men have ceased doing prostatectomy, and employ resection exclusively. It is a common experience to hear from fellow urologists that they have not done a prostatectomy, or only a few within the last year or two.

There can be no question that electro-surgery of the prostate and bladder neck obstructions has been an advance in our means of successfully treating these conditions. This procedure has come to stay. With increased interest in the pathology of the bladder neck there has developed a greater interest in the study of the physiology of this structure. The resectoscope has permitted us to observe the pathologic anatomy of the prostate and prostatic urethra far more accurately than can be determined with the cystoscope, or the finger in the rectum. Because non-operative therapy has become routine with many urologists, litholapaxy, a very valuable procedure, has been revived, and many men who had previously performed cystotomy for the removal of bladder stones are now crushing them. It was to have been expected, that with a new instrument that had not been perfected, and during the time required for the development of a technic, the mortality and morbidity would be high at the beginning of the resectoscope era. The mortality rate was 20-25 per cent in the early series of cases. At the present time, with proper pre-and-post-operative care, the mortality rate has been markedly reduced. Some men claim practically no mortality. One large series of almost 300 cases shows a mortality rate of less than 3 per cent. Statistics gleaned from reports of various clinics show the average mortality rate to be 6-8 per cent.

It is well understood that transurethral resection is a major procedure, and that the patient should not be told that it is merely a minor procedure that can be done almost

as well in the office as the hospital. Although a number of patients will require hospitalization for only 5 to 7 days, many require a longer hospital stay.

My personal experience with electroresection has been with approximately 60 cases. Of these, there were two in whom the resectoscope could not be inserted—the prostate was too large. Two others bled profusely in attempting to pass the instrument, and cystostomy, and later, suprapubic prostatectomy were done. Many urologists are agreed that a bleeding prostate or marked traumatic bleeding is a contraindication to resection. Two patients required cystostomy within 48 hours in order to control bleeding—one of these died later. Two had marked ascending pyelonephritis and died. One died of ileus, a complication not often mentioned. I have done cystostomy as a preliminary procedure in over 20 cases—none of these died. I have always considered cystostomy a safety valve. With an opening above any of the three procedures, perineal, suprapubic or transurethral can be done quite safely.

My position regarding transurethral resection is one of conservatism. In from 10 to 20 per cent of the cases in the hands of urologists who do electroresection routinely, cystostomy has been necessary, usually preliminary to resection; and also a few following resection in order to control bleeding and ascending infection. A number of patients also have bladder calculi.

Not all stones can or should be crushed. Bladder diverticula are occasionally found which require surgical removal. Difficulty is often encountered in catheter drainage. Some patients cannot tolerate a catheter, severe bladder infection is often present which does not respond to catheter drainage. It may be difficult, or impossible to insert a catheter in acute urinary retention. There have been a few times that a patient has had a high fever and chill following resection where I would have been happier with a cystostomy as a preliminary measure.

In order to prevent epididymitis, bilateral vasectomy is also done routinely.

Those who have in the past, and who are now doing two-stage prostatectomy have always felt that suprapubic drainage is far superior to catheter drainage. The reten-

tion catheter is a double edged sword — it also promotes infection.

Statistics regarding the value of transurethral resection should not include those cases in which a cystostomy has been done as a preliminary measure — all statistics should be limited to resection with the closed bladder. Once a bladder has been opened, except for cases of contracture of the bladder neck, I fail to see the wisdom in doing resection when prostatectomy can assure the patient permanent relief.

The mortality rate in perineal prostatectomy has been even lower than that of two-stage suprapubic prostatectomy. The men who have been doing perineal surgery have, in the main, not discarded this route for transurethral resection. The mortality from two-stage suprapubic prostatectomy, among good urologists has been not more than 5 per cent.

There are a great many more resections done now than were prostatectomies in the past. Many patients who needed surgery, but who refused, now feel safer with resection and subject themselves to it. There are, however, many more who have only a mild degree of obstruction or relatively little distress, who in the past got along fairly well with massage and dilatation, and who are now being resected. These latter patients are good risks, and with little residual urine, usually undergo rapid convalescence — in 3 to 7 days. How many of these latter patients should undergo resection? Sometimes their postoperative course is quite stormy, and occasionally fatal.

Many of the cases of prostatic resection run a stormy course. Prolonged bleeding, repeated attacks of hematuria, and pro-

longed bladder infection, frequently require repeated visits to the hospital.

In the past, many men have hesitated to perform cystoscopy in prostatic hypertrophy. It was often considered a more formidable procedure than the opening of the bladder. The resectoscope, a larger calibered instrument than the cystoscope, can also not be inserted with impunity. The prolonged instrumentation frequently required in order to properly remove the obstruction may produce severe reactions. Urethral shock can and does occur.

Resection has proven valuable in tunneling a channel for cancer of the prostate causing obstruction. It is better than the permanent suprapubic drain which was routine in the past. In from 10 to 20 per cent of the cases in which the prostate has been removed, apparently for benign hypertrophy, carcinoma is found, usually in its early stage. In many cases prostatectomy will cure the patient with early cancer of the prostate, because extension had not yet occurred. With the resectoscope it is not possible to cure the early cases of cancer of the prostate.

My stand on the subject of electroresection of obstructions of the bladder neck is the following. I have done resections and will continue to do them but I feel that the procedure should be limited to bars, contractures, and minor degrees of hypertrophy. This, in my opinion, will comprise not more than 30 per cent of bladder neck obstruction requiring relief. For the majority of cases two-stage suprapubic, or perineal prostatectomy is by far more satisfactory and safe.

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CLINICAL AND POSTOPERATIVE STUDY OF PROSTATIC RESECTIONS *

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Clinical study of cases requiring surgery of the prostate, especially resections, embraces a group of patients who have symptoms of prostatism. These patients present a picture similar to those for whom formerly enucleation of the hypertrophied gland was the operation of choice.

In the beginning the revisionists or resectionists were very bold in advocating resections for all types of cases. This necessarily resulted in a morbidity and mortality that was out of all proportion to its predictions. A further observation was made that many more prostates were being operated upon than ever before. Whether this came about as a result of the general public becoming fearless, or cases that ordinarily were not operated upon were now being subjected to surgery, are questions which can only be answered by those who performed the operations. In reviewing the cases that have been operated on by many surgeons, it was seen that many had few symptoms, and little or no residual urine. These patients should never have been resected. There is a difference of opinion among surgeons as to when a patient suffering from prostatism should be subjected to a transurethral operation. Our position at the Sinai Hospital places us in a conservative group. Prior to the vogue of prostatic resections, our results in prostatectomy have been satisfactory, our mortality ranging between 4.8 and 4.9 per cent. We have practiced both the perineal and suprapubic operations, the largest percentage being performed by the former method. We, therefore, have been quite satisfied with the open operation. Having unbiased minds, we were willing to experiment, and while our series is small, we have concluded that we shall remain conservative and perform transurethral operations only on selected cases.

Clinical Study

Our series comprises fifty patients for

whom we decided that a prostatic resection was the best operative procedure. They are divided into the following groups:

1. Cases of median bars.
2. Cases of middle lobe enlargements.
3. Cases with only a small lateral lobe enlargement.
4. Cases of carcinoma of the prostate.
5. Cases of stricture of the vesical neck.
6. Cases of postoperative prostatectomies having symptoms of prostatism.
7. Poor surgical risks with symptoms of prostatism.

We prepared all our cases the same as for prostatectomy, namely:

- (1) Bilateral resection of the vas deferens was performed on admission or shortly after.
- (2) A retention catheter was placed in the bladder for at least a week or longer, depending upon the course of the blood chemistry. When stabilization was reached, we proceeded.
- (3) Fluid intake was forced.
- (4) The cardiac and respiratory systems were put in the best possible condition.
- (5) There was no haste in performing the operation for the sake of reducing the expense.

The ages were as follows:

- 50-59 years — 19 cases.
- 60-69 years — 19 cases.
- 70-79 years — 11 cases.
- 80-90 years — 1 case

The duration of the symptoms was:

- 1 to 3 months — 13 cases.
- 4 to 6 months — 6 cases.
- 7 to 12 months — 11 cases.
- 1 to 2 years — 2 cases.
- Over 2 years — 18 cases.

All cases had some urinary frequency during the day and night. Nineteen cases suffered with painful urination. Forty-five cases complained of urinary hesitancy. Residual urine varied according to the following:

- Under 1 ounce — 3 cases.
- 1 to 2 ounces — 3 cases.
- 3 to 6 ounces — 3 cases.
- Over 6 ounces — 26 cases.

* From the Department of Urology, Sinai Hospital, Baltimore, Maryland.

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 14, 1933.

There were 40 cases that gave a history of complete urinary retention at some time. Seventeen cases had infected urine before operation, and in 33 cases the urine was not infected. There were 9 cases that had a systolic blood pressure of over 180, while in the remainder the systolic pressures were between 130 and 180. There were numerous preoperative complications which are listed as follows:

Genito-Urinary

1. Renal calculi — 1 case.
2. Marked bilateral pyelonephritis — 1 case.
3. Vesical calculi — 2 cases.
4. Vesical and ureteral calculi — 1 case.
5. Vesical diverticulum and one kidney removed — 1 case.
6. Urethral stricture — 2 cases.
7. Rudimentary kidney — 1 case.
8. Tuberculosis of the genital tract — 1 case.

Preoperative complications other than genitourinary:

1. Cardiac Complications:
 - (a) Two cases had marked cardiac hypertrophy.
 - (b) Two cases had marked myocarditis.
 - (c) One case had attacks of angina pectoris.
2. Respiratory Complications:
 - (a) Three cases had marked emphysema.
 - (b) Two cases had severe chronic bronchitis.
 - (c) One case had non-tuberculous pulmonary infection.
 - (d) Five cases had pulmonary tuberculosis, two of which were active.
3. Renal Complications:
 - (a) Three cases had chronic diffuse nephritis.
4. Vascular Complications:
 - (a) One case had thromboangiitis obliterans.
5. General Complications:
 - (a) Two cases had inguinal hernia.
 - (b) One case had diabetes mellitus.
6. Uremic Complications:
 - (a) Three cases had chronic uremia.

Functional Studies. 1. The blood chemistry in all but nine cases was higher than normal on admission, and the phthaleins were lower than normal in 41 cases. The lowest blood urea on admission was 28 mgms. per

cent. In most instances they were admitted with blood ureas above 50 mgms. per cent. Three cases had ureas above 100 mgms. per cent on admission, while two cases ranged at all times between 125 and 366 mgms. per cent.

2. All cases were cystoscoped preoperatively and had some form of obstruction producing symptoms. They were classified as follows:

- Median bars — 7 cases.
- Median lobes — 9 cases.
- Lateral lobes — 3 cases.
- Lateral and median lobes — 28 cases.
- Stricture, vesical orifice — 3 cases.

Three of the above cases were demonstrated to have carcinoma of the prostate, two of which were diagnosed preoperatively.

As this paper does not include a discussion of the operative procedure, we shall merely make mention that 29 cases were operated upon under spinal anesthesia, and 21 cases under caudal anesthesia. The amount of tissue removed was between 1.5 grams and 11 grams, with an average of 3.2 grams.

Postoperative Study. Particular care was taken for the comfort of the patients, to insure as little pain as possible. All the systems of the body were carefully observed, particularly the renal, cardiac, and respiratory systems. Cardiac stimulants were given when necessary. Particular stress was paid to the intake of large quantities of fluids. Nourishing foods were given early. A purgative was administered on the second day. Enemas were not given unless absolutely necessary, to avoid embolic phenomena. For that same reason we advised patients to avoid straining.

In addition to the above generalities, we concerned ourselves with certain postoperative conditions:

1. Epididymitis.
2. Retention catheter effects.
3. Bleeding.
4. Renal infections.
5. Bladder infections.
6. Urination.
7. Sloughs.
8. Postoperative residual urine.
9. Postoperative cystoscopy.
10. Complications.
11. Hospital days.
12. Results.

1. *Epididymitis.* In ten of our early cases vasectomies were not performed. In four, or 40 per cent, epididymitis resulted. In the 40

cases where vasectomies were performed, no epididymitis developed.

2. *Retention Catheter Effects.* Immediately after operation a retention catheter was inserted and kept in place. We experienced some difficulty in getting the catheter to work properly. We observed that after the edema subsided, which was in 24 to 48 hours, the catheter would be forced forward, and then there was either no function at all, or one with difficulty. Under these circumstances, it was necessary to either readjust the catheter or remove it and reinsert another one. This always entailed some pain which made the patient very uncomfortable, and frequently started some bleeding. In our more recent cases we found it best to place the catheter somewhat farther in the bladder than ordinarily, to avoid all unpleasantness.

It is of utmost importance that catheters should not become plugged. This has occurred in many instances. The blocking is usually due to purulent material or to blood clots, and, on several occasions, to sections of tissue which were not removed at the time of the operation.

In our early cases we removed the catheter in three or four days. We have learned that this practice is not the best, because there still remains some edema from the operation and the resected areas are not healed. As a result the patient has a good deal of painful urination with marked straining at times, even to the point of causing a retention, necessitating reintroduction of a catheter. Our procedure now is to leave the catheter in the bladder for from six to seven days.

3. *Bleeding.* We have not practiced continuous or frequent irrigations. We feel that in the case of bleeding if frequent irrigations are used, clots are washed from the bleeding points and bleeding is renewed, or that the blood will be mixed with such a large quantity of fluid that the amount of bleeding will not be accurately determined. Irrigations are, therefore, only used when necessary.

There have been a number of cases of postoperative bleeding. These were carefully watched and determined from the readings of the blood pressure, the color of the drainage, and the blood studies.

We had only three cases of severe postoperative bleeding. One occurred immediately after operation and continued for three days. He was given several transfusions. On

the third day it was decided that a suprapubic cystostomy should be done, but suddenly the bladder ruptured through an old scar. Subsequently, the bleeding ceased, but he remained shocked for quite a time.

Our second case of hemorrhage occurred ten days after operation, and four days after the patient had left the hospital. He was readmitted and a catheter was introduced, causing the bleeding to cease.

Our third case of severe bleeding occurred immediately after operation, but was not recognized. Blood was coming from around the catheter and we felt that it might be anterior urethral bleeding, due to instrumentation. The blood pressure studies in this case never revealed a great variation. The bladder did not seem to become distended and very little drainage came through the catheter. Aware that we had preoperatively an individual with badly damaged kidneys, we felt that we were dealing with a case of urinary suppression. The usual treatment of intravenous and subcutaneous introduction of fluids was carried out. Fluids injected into the bladder through the catheter would return, but were bloody. The bladder did not seem to be distended on percussion. He died three days after operation from uremia. In addition to other pathologic changes found at autopsy in practically every organ of the body, his bladder was filled with a large numbers of blood blots.

What had taken place was postoperative bleeding, the clots filling his contracted bladder, pressing against the ureteral orifices, and preventing the urine from entering the bladder. The result was similar to what occurs when there is a bilateral ureteral obstruction, particularly when both kidneys are the seat of extensive disease, as in this case. In view of the autopsy findings, it is debatable whether the outcome would have been different had the vesical bleeding been recognized.

All operative cases, aside from the aforementioned, had very little postoperative bleeding. In most instances, the greatest amount of bleeding was observed shortly after the patient was returned to bed. This undoubtedly is due to the rise of the blood pressure or rather to the return of the blood pressure to its normal height. In the largest percentage of cases bleeding lasted from 24 to 48 hours, then ceased and returned when the catheter was removed and the patient started voiding. This was particularly observed when the

sloughs were breaking away. This bleeding was never severe with the exception of the one patient who was readmitted to the hospital (mentioned above).

When bleeding was only moderate, we have not practiced irrigations except for obstructions of the catheter. We are of the belief that if clotting can occur over the bleeding points, there is a far better chance for a cessation of the bleeding.

4. *Renal Infections.* This occurred in 25, or 50 per cent of our cases. The explanation of this is simple. In many instances some renal affection was present to begin with. Whether it is or not, is not the greatest factor, that rôle falling to the trauma produced at the time of operation in the posterior urethra. This is followed by a foreign body (catheter) being placed in the urethra. The prostatic urethra is rich in lymphatics and these in turn connect with the lymphatics of the bladder, ureter, perirenal capsule, and cortex, favoring a lymphogenous infection into the kidney cortex.

Infection has caused us more concern than any one other complication. It usually sets in between 12 and 36 hours after operation, causing lumbar pain in some instances, a definite rise in temperature, chills, decreased urinary output, and frequently nausea and vomiting. The condition usually lasts from four to twelve days. Our method of treatment has been to force fluids, apply heat to the lumbar region, and when feasible, to remove the catheter. There were no deaths.

5. *Bladder Infections.* Seventeen, or 34 per cent of the cases, had infected urine before operation. One hundred per cent of the cases had infected urine after operation, and remained infected up to the present writing. While the infection has decreased in all cases, and is tolerated in most instances, it has been rather annoying both psychologically and symptomatically. Bladder irrigations with potassium permanganate or argyrol together with the forcing of fluids have been used to combat the infection.

6. *Urination.* Immediately after removal of the catheter and thereafter for two to four weeks, there has been urinary frequency in all our cases. After the fourth week this symptom subsided somewhat. Our cases were at their best, regarding urination, between three and four months after operation. At this time they have been able to retain

their urine in the largest percentage of cases for from three to four hours during the day, and void once or twice at night. In 18 per cent of our cases urine cannot be retained any longer than two hours during the day, and the patients void twice at night between the hours of 10 P. M. and 6 A. M. A post-operative symptom that persisted in all our cases for at least two months, was painful urination, particularly when the last portion of urine is being discharged from the bladder. This has been an annoying symptom for which we have advised hot sitz baths. Irrigations in the beginning are not tolerated very well, and in many instances start some bleeding.

7. *Sloughs.* It has been our experience that postoperative sloughs continue to pass for as long as three months. We have observed that the more intense the fulguration the more sloughs are going to be passed. We have also made the observation that as long as sloughs are present in the bladder there is some pain on urination, some frequency, and some infection. The reason is that the operative procedure has been carried on in the prostatic urethra and the neck of the bladder, and that area must be healed before there can be any relief from these symptoms. In some cases, those sloughs have caused urinary obstruction. This occurred in three, or 6 per cent of the cases where some resected tissue remained in the bladder, the removal of which produced relief.

8. *Postoperative Residual Urine.* Tests were made to determine:

1. Immediate postoperative urine, residual.
2. Late postoperative urine, residual.

In the first procedure the test was made by emptying the bladder with the retention catheter in it, then injecting the bladder with fluid to capacity (noting the amount). The catheter is removed and the patient is requested to void. This voided amount is measured and if any difference exists, it can be considered as remaining in the bladder as residual urine.

- 30, or 60 per cent, had no residual urine.
13, or 26 per cent, had residual urine — 15-30 cc.
4, or 8 per cent, had residual urine — 30-60 cc.
3, or 6 per cent, had residual urine — 60-180 cc.

At the end of three months residual urine

was again determined with the following results:

- 33, or 66 per cent, had no residual urine.
- 10, or 20 per cent, had residual urine — 15-30 cc.
- 4, or 8 per cent, had residual urine — 30-60 cc.
- 3, or 6 per cent, had residual urine — 60-180 cc.

The ten cases that had between 15 and 30 cc. residual urine were perfectly comfortable and, therefore, were not disturbed. The four cases that had between 30 and 60 cc. were reoperated upon with a result that the residual amount was reduced. The three cases that had between 60 and 180 cc. residual urine refused a second resection. Perineal prostatectomies were performed on these cases with excellent results.

9. *Postoperative Cystoscopy.* A postoperative cystoscopy study was made in all cases after a lapse of about eight weeks. In most instances areas of slough could still be observed at the neck of the bladder. Edema and irregularity of the orifice were always seen, and in some cases there was definite encroachment of prostatic tissue at the vesical orifice or at the prostatic urethra. If there was any appreciable amount of residual urine and the patient had definite urinary symptoms, a second prostatic resection was considered. On cystoscopy, in all cases, a definite groove could be seen where the prostatic tissue had been removed.

10. *Postoperative Complications.* Twenty cases, or 40 per cent were poor surgical risks because they had numerous preoperative complications. Due to this, we anticipated many postoperative complications. In addition to pyelonephritis which occurred in 25, or 50 per cent, we encountered the following postoperative complications, in 24 per cent of the cases:

- a. Bronchopneumonia — one case — died.
- b. Hemorrhage, severe — three cases — one died.
- c. Blood stream infections — two cases — one died.
- d. Carcinoma, lumbar spine — one case — died.
- e. Epididymitis (not vasectomized) — four cases — one operated upon.
- f. Pulmonary infarct — one case.

11. *Hospital Days.* Considering that 20, or 40 per cent of the cases, were poor surgical risks, the hospital days were much longer

than one would expect to have with good surgical risks. Even in the good surgical risk cases, there was more time spent for preparation than after the operation.

The hospital days varied from 12 to 121 days, with an average of 31.5 days. The preoperative hospital days varied from 2 to 75 days, with an average of 21 days, while the postoperative days varied from three to forty days, with an average of 10.5 days.

12. *Results.* Four, or 8 per cent, died. Three, or 6 per cent, had a perineal prostatectomy performed after resection. Four, or 8 per cent, had secondary prostatic resections. One, or 2 per cent, had a third prostatic resection. Thirty-two, or 64 per cent, have expressed themselves as feeling perfectly well. Eleven, or 22 per cent, have stated that they are somewhat improved, but do not feel that they had a perfect result. Ten, or 20 per cent, were not vasectomized with a result that four of these, or 40 per cent developed epididymitis. None of the cases that were vasectomized developed an epididymitis.

Discussion of Deaths. One patient died of postoperative hemorrhage. Whether death would have resulted anyway is debatable. One patient died of postoperative pneumonia. One patient died of postoperative septicemia, probably due to too much trauma around the prostatic urethra. One patient died of carcinoma of the lumbar spine following a prostatic resection for carcinoma. This death, undoubtedly, had no bearing on the prostatic resection.

Conclusions

1. Prostatic resection should be performed in selected cases and does not replace prostatectomy. Each has its place.

2. Prostatic resection should be performed at an early stage to prevent large hypertrophies.

3. Poor surgical risks can be resected with greater safety than operated on by the open method.

4. Transurethral resection should be considered a major operation, and the patient prepared in every detail, regardless of expense.

5. Bilateral vasectomies should always be performed.

6. Trauma should be minimized to avoid postoperative infections.

7. Fulguration during operation should be applied discriminately.

8. The patient should be returned to bed as quickly as possible.

9. Retention catheters should be left in the bladder at least one week postoperatively, providing there is no renal infection.

10. Careful follow-up of all cases is highly desirable.

601 Medical Arts Building.

(For discussions turn to page 292)

FUNDAMENTAL PRINCIPLES AND RESULTS OF TRANS-URETHRAL SURGERY *

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ERIE, PA.

Correction of prostatic obstruction has always been a problem of the surgeon-urologist. When Belfield, Fuller, and Young began to develop the surgical relief of this condition, their work was attended with great morbidity and mortality, the reason being that usually prostatic obstruction came in the elderly male, embarrassed by a poor cardio-vascular-renal system and a poor gastrointestinal tract. This was augmented and aggravated by infection and the resulting retention, in the individual's system, of materials which normally should be eliminated. Due to the efforts of pioneer workers and others later interested in the relief of these elderly men, the mortality of prostatic surgery in the hands of the expert was reduced from about fifty to eight or ten per cent.

The operation was made successful, primarily, by reason of preliminary adequate drainage of the urinary tract, but it has always been one of serious moment, whether done by the suprapubic or the perineal route, and has always required varying lengths of time for preoperative preparation and a long time for postoperative convalescence. Various methods have been devised to control hemorrhage and shock, postoperatively, and to correct the complications which arose in these debilitated patients. Prostatectomy was still hazardous and a terrible ordeal to the patient, if successful, and the treatment was based, for the most part, upon preoperative drainage and the complete removal of the entire hypertrophy.

Development of Transurethral Method

Transurethral attack upon the gland has developed ever since Young brought forth the

cold steel prostatic punch. Today the urologist has a procedure which has completely revolutionized the handling of the prostatic patient. While the true place of this method in prostatic surgery has not been completely evaluated, it does result in less risk and less discomfort than is possible under any of the open operative procedures⁽⁴⁾.

During the years of development many important observations have been made and recorded, the three most important of which became the forerunner of the present transurethral attack.

1. Often it is only necessary to remove a portion of the gland to get symptomatic and clinical cure.

2. These same results could very often be obtained by skilled operators with transurethral instruments designed to punch out the obstructing portions of the gland, even though the original instruments were blind and hemorrhage was difficult to control.

3. The transurethral removal of the obstructing portions of the gland were much easier on the patient, providing there was little or no complicating hemorrhage.

Together with this knowledge and with the help of skilled instrument makers, workers in urology began to devise ways and means of attacking the prostate, transurethral, with instruments that could be passed through the penis and equipped with lighting arrangements so that the operator could see exactly what portion of the prostate was obstructive and should be removed. They were so constructed that the obstructing tissue could be removed rapidly and with a minimum of hemorrhage. In the old open surgery, hemorrhage was the great immediate danger.

Caulk⁽⁵⁾ developed the actual cautery as a

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means of removing the tissue under direct vision. With the development of high frequency electrical currents, the problem became simplified. Bumpus⁽⁶⁾ and Kirwin⁽⁴⁾ use coagulation, cutting-loops and punch, while McCarthy⁽²⁾, Davis⁽¹⁰⁾, Kretschmer⁽⁹⁾, Alcock⁽⁵⁾, Collings⁽³⁾, Day⁽⁷⁾, and others, use the cutting radio tube or spark gap currents, with the loop to cut out the tissue and coagulate the bleeding points. All of this resulted in instruments that could be inserted through the urethra with the operative procedure being done under direct vision; thus full control of the posterior urethra, the bladder neck and the bladder cavity is possible at all times, the cutting by electrical current being accomplished under direct vision.

In the open operation an attempt is made to remove the entire gland. This is very often impossible in carcinoma⁽³⁾. The operation is a fairly blind procedure except in the perineal approach and shock and hemorrhage are of great magnitude. By the transurethral method as little or as much prostatic tissue may be removed as the experience of the operator indicates^(2, 3). The procedure, with the modern instruments, is not in any sense a blind one. Every strip of prostatic tissue is removed under perfect visual control. In the hands of the expert, the obstructing part of the prostate is removed from the verumontanum to the floor of the bladder and as much of the lateral lobes as is necessary. The important thing to remember is that no tissue should be removed anterior to the verumontanum because of the danger of injury to the compressor urethrae muscle⁽²⁾. No attempt is made during the operative procedure to save the so-called internal sphincter. This muscle has been completely paralyzed, as a rule, by the enlargement of the gland, intravesically. It has long been known through the teachings, particularly of Caulk⁽⁸⁾, that if the obstructing part of the gland is removed, there is a recession of the swelling and congestion in the rest of the gland, which materially aids in the clinical cure of many cases. Therefore, it is not always necessary to remove all of the gland.

Prostatic Hypertrophy, Its Symptoms and Pathology

Let us review for just a moment what the pathological⁽¹⁾ and clinical picture of prostatic hypertrophy really is, and what must be ac-

complished to relieve this condition. The symptoms that ensue as a result of prostatic obstruction may be few or many. The obstruction may be caused by the whole or a part of the hypertrophied gland. This has been proven time and time again when the obstructing portion has been removed with complete symptomatic relief. Usually the middle lobe, even with large bilateral lobe hypertrophy, is the obstructing portion⁽⁴⁾. After obstruction takes place there is urinary stasis in the bladder with muscular hypertrophy and later muscular distention. This process may be limited to the bladder but later is frequently transmitted to the ureters and the pelvis of both kidneys with the development of hydronephrosis and its subsequent renal impairment eventually resulting in infection which complicates the whole pathological process.

The symptoms may be incontinence or really the overflow of retention. This means, of course, a day and night frequency which breaks the rest and cripples because of this break. From this frequency of urination additional symptoms may be encountered because of the fundamental pathological condition present that is secondarily and progressively present in the rest of the urological tract as a result of the mechanical obstruction from the prostate itself. The relief of these symptoms, in the vast majority of cases, can be brought about by the present day development of transurethral surgery.

Let us now discuss the fundamental principles of the transurethral procedure. Pre-operative drainage must be instituted as in the old, open operative method. This can be done in three ways: First, by continuous catheter drainage⁽²⁾; second, by intermittent catheter drainage⁽²⁾; and third, by suprapubic drainage⁽²⁾.

If the vas is tied on both sides upon the patient's admission to the hospital, the danger of epididymitis as a complication of catheter drainage is minimized. Most of the advocates of the open operation ligate the vas for the same reason, hence there is little to choose in the preoperative treatment in either case. The indications for and against these three methods of drainage are identical in both procedures and are carried out in the same manner.

Anesthesia has always been a dangerous procedure in the open prostatic operation.

Ether, gas, spinal, or sacral anesthesia must be used by those doing open operation. The least dangerous of all these anesthetics, of course, is sacral block and local analgesia. They put no extra stress upon the heart, cause no blood pressure disturbance, do not injure the kidney and do not disturb the gastrointestinal tract. In transurethral procedures sacral anesthesia is the method of choice, but in the hands of some operators a very low spinal is used. In this way, a well-trained urologist can remove the obstructing tissue with the least anesthetic risk. In about two per cent of my own cases sacral anesthesia is inefficient and in these cases it is necessary to resort to a low spinal anesthesia.

Transurethral surgery with any of the improved methods now in use by skilled urologists is perhaps one of the most difficult technical procedures to perform. Only well-trained and efficient operators should attempt to do this work. It is not a procedure without great danger in the hands of the untrained and the unskilled^(2, 3, 4, 5, 6, 7).

Due to the fact that the anesthesia is the least disturbing, the procedure carried out under direct vision, with very little bleeding and with the proper preliminary drainage, the convalescence of the patient, as a rule, is not stormy nor beset with many serious difficulties. The hospitalization period, in the vast majority of cases, is limited to a few days as compared to weeks by the open surgical procedure^(2, 5, 6).

Comparison of Mortality Rate

To be a successful surgical procedure, transurethral attack upon the hypertrophied prostate must meet certain requirements. These are based upon the results obtained, figured not so much in mortality percentages, although this is important, but in morbidity. Let us, for the moment, look at mortality^(2, 3). Some extremely competent men such as Alcock⁽⁵⁾, Day⁽⁷⁾, and other skilled urologists have reported many deaths in their first hundred cases, the deaths becoming much more infrequent as their experience enlarged, while other men equally competent have reported mortalities astoundingly low. Kretschmer⁽⁶⁾, I believe, has only had three deaths in a series of over one hundred and eighty cases⁽³⁾. Between these two extremes there is undoubtedly an average, and from my own experience, conversations, and communications with prac-

tically all of the men doing resection work, I would say that perhaps the mortality can be figured at about the same as in the old open operative procedure, say about five per cent in the hands of competent men who pay meticulous care to their preoperative preparation^(2, 6).

My mortality has been high, but I believe this has been due to the fact that I have attempted to relieve patients by this method whom I never would have dared touch by any open procedure. I am thankful to say that many thus attempted have been unusually successful. I feel confident that this procedure opens up an avenue of relief for a large group of patients otherwise immediately condemned.

I will review quickly some of the causes of death in my own experience. Postoperative cystitis and ascending pyelonephritis with uremia rank high. Strangely enough, my first death came a week after resection in a gentleman whom I considered a perfect risk and pyelonephritis with uremia was the cause. I have never yet lost a case because of hemorrhage, either primary or secondary. Several of my patients died of coronary thrombosis and one of pulmonary embolism, several days to two weeks following operation, but these fatalities might have occurred without any operative procedure. For example: One patient, sixty-four, died of coronary thrombosis while in bed being prepared for a resection. There had been no operative procedure. However, he was having intermittent catheter drainage with bladder lavage three times a day. Had I operated upon him he would have been a resection mortality.

There have been eighteen deaths in my series of a little over one hundred and fifty cases. This is high, but I have the satisfaction of knowing that I have given every sufferer from prostatic obstruction who has consulted me, his chance.

I do not believe that we should take the mortality too seriously in these old prostatic risks. Unrelieved, they have a short life at the best and a very miserable and uncomfortable one. Most of them would rather be dead than suffer as they do; most of them have lived their allotted time and, if successfully operated upon, most of them are so generally debilitated that their longevity is naturally limited. True, we medical men talk in terms of mortality but while, naturally, I am anx-

ious to have my patients get well, I am much more interested in their morbidity, and here is where transurethral procedure stands completely on its own feet in comparison with any of the old open operative procedures⁽⁵⁾.

After resection, the vast majority of these old men can have their retention catheters removed on the third or fourth day and they are usually able to void a reasonably good stream at once. They do not have to lie in a pool of urine, waiting for their suprapubic wound to heal. They are up in bed on the fourth day and usually out of bed on the fifth day and home shortly thereafter. Their hospital postoperative stay is cut from four to six weeks to a few days or two weeks, providing, of course, complications do not arise⁽²⁾.

Complications

Now I wish to review some of the complications that have occurred in my own work. I do a preliminary ligation of the vas in all cases, and yet in spite of this there have been several cases of epididymitis. This is usually merely an uncomfortable and troublesome entity and seldom requires surgical attack. It usually subsides in a few days if the testicle is placed on a bridge and packed in ice.

Troublesome hemorrhage has occurred in three cases but none proved fatal. One case was controlled by continuous two-way catheter irrigations which prevented the clots from forming in the catheter and occluding it. In one case, the hemorrhage seemed to be perfectly controlled when the patient left the operating room. However, he tore his catheter out and it was necessary to reinsert it. This started fresh hemorrhage. Several hours later a clot plugged the catheter and while fluid could be forced into the bladder there was no return flow. That night the patient was returned to the operating room, the sheath of the resectoscope inserted and a huge quantity of blood clot evacuated. The catheter was replaced. Drainage now seemed perfect and in the next twelve hours there was a total drainage of eighteen ounces of urine. The following morning the pulse and temperature were normal, but the patient complained of a severe localized soreness above the pubis and to the right. During that day the urinary drainage was normal and satisfactory but the pain in the right suprapubic region increased during the following night, and although the

urinary drainage was still satisfactory and with very little blood, his pain increased. Seventy-two hours after operation the area of soreness had enlarged and the slightest pressure over the right lower quadrant of the abdomen caused intense pain. He was removed to the operating room and the bladder exposed suprapubically. The perivesical tissues were filled with bloody urine and the peritoneum had been dissected off the bladder, the extravasation being entirely extra-peritoneal. Just posterior to the trigone there was quite a good-sized rupture in the bladder wall and this was filled with a dumbbell blood clot. I had accidentally burned a hole through the bladder wall at this point or else because of overdistention, either during the operation or when the blood clots were evacuated, a cellulite in the bladder wall had ruptured. Suprapubic drainage was instituted and two large cigarette drains were placed down into the deep perivesical spaces. There was a stormy convalescence of two months. This patient is alive and as well today as a man can possibly be who has a bad cardiovascular system. His bladder empties, he is up once at night, and he considers the result perfect.

A large percentage of my patients found that they had dribbling for some time after they were up. This dribbling lasted usually for a few weeks and then perfect control was established. The longest case of postoperative dribbling was in an elderly man of seventy-four but after three months he regained good control. Many of my first cases carried varying amounts of infected residual urine. Two cases had to be re-resected because their residual was still too high after months of postoperative treatment, mainly because I had not removed enough of the obstructing prostate at the first sitting⁽⁵⁾.

Removal of Prostatic Tissue

I would like to discuss the removal of prostatic tissue. The advocates of the open operation claim that this procedure is to be preferred because all of the prostate is removed. In a very large majority of cases this is not true. The adenomatous hypertrophy usually starts in the glands of the commissure in the posterior urethra and as this glandular tissue undergoes hyperplasia it presses the true prostate out so that it forms the capsule of the adenomatous hypertrophy. It has been demonstrated time and time again by Caulk⁽⁸⁾ and

others that it is not necessary to remove all of the hypertrophied adenomatous prostate but that it is essential to remove that part which causes the obstruction. Is it not far preferable to have a patient still carrying some pathologic material, who is practically clinically free from symptoms and who can almost completely empty his bladder, alive and comfortable with a minimum of shock than it is to have one completely relieved of all of his symptoms, dead or crippled and uncomfortable? Practically all of these patients will complain for a while, perhaps two or three weeks, of a terminal pain upon voiding, but the vast majority of my patients have been so free from uncomfortable symptoms that it is difficult to convince them that they have had any real operative work done.

I have only been obliged to re-resect twice in adenomatous enlargement. Most of the carcinomas of the prostate, however, will, if they live long enough, come to the second and perhaps third operation, but compare the simplicity of tunnelling a carcinomatous prostate with clinical relief in these incurable cases, to any attempts you have ever seen to remove the carcinomatous prostate, except in the very early cases, by open operation. As this procedure is the least shocking of all operative attacks, I do not think that any other method should even be contemplated in carcinoma. Successfully performed, postoperative complications are few as compared to those experienced by all of us in the open operation, and the convalescence is comparatively so mild that the word "minor operation" has, unfortunately, crept into the description of resection. These patients of mine, comparing their results with men operated upon by myself and others, who have been subjected to open suprapubic or perineal prostatectomy, consider that the procedure must be a minor one.

Certain urologists do this operation in their office, and to popularize the procedure among the laity have, undoubtedly, referred to it as minor surgery. It may be minor to some people, but anything a surgeon urologist does to these crippled prostatics, assumes major proportions from the beginning, and as for the operator, well, the most difficult work I have ever tackled has been in prostatic obstruction, classified from Grade 2 to 4. It certainly is not a minor procedure from the operator's point of view.

Comparison of Results

It has been difficult to compare the results obtained with resection with those obtained by prostatectomy, yet I have tried to make some comparison. These comparisons are only interesting and of no special value, because it has been impossible to check up routinely many of these patients. The time factor also enters into comparison, and it will take ten years to properly evaluate the end results of this procedure. None of these cases, of course, have lived sufficiently long as yet to allow final comparisons. I am, however, firmly convinced in my own mind that resection cases will live as long, will be as comfortable and as happy as any of the cases that I have ever relieved by open operation, and I am satisfied that postoperatively these cases have a happier, shorter, and cheaper convalescence. I decry the fact that bladder neck contractions, the so-called fixed inflammatory or collar-necked bladders are included in the studies which are now being made. These cases are simple and require little preoperative preparation.

The only cases that should be considered for statistical purposes are the prostatic adenomas and carcinomas in elderly men. The adenomas have been graded according to size as 1, 2, 3, and 4. A great number of competent urologists who are resection enthusiasts, believe that 1, 2, and 3, should be resected, while Grade 4 should be submitted to open operation^(4, 5).

A year ago at Pittsburgh, I opened the discussion on Dr. Joseph McCarthy's⁽²⁾ paper before the Section of Urology at the Pennsylvania State Medical Meeting, and I then said that I had not done an open operation since I had trained myself to do resection; and that I would never do an open prostatectomy again unless it was impossible to do a resection, because of anatomical anomalies, or until I had tried resection and utterly failed. I have not done an open operation on the prostate since making that statement. I have attempted to relieve every patient that has been sent to me, whether his prostate was graded 1 or 4, and so far I am satisfied that resection has found its place.

May I add in explanation, that it has been necessary to prepare some of my patients for resection by suprapubic drainage. I expect occasionally to be forced to do an open pros-

tatectomy, but that will in no way detract from the success and efficiency of resection in the vast majority of prostates that I hope to see in the future.

8 East 12th St.

Conclusion

The success of resection is in direct ratio to the skill and experience of the operator. This is work for urological surgeons who are expert instrumenteurs and who know minutely both the pathologic and the anatomic structures of the posterior urethra and vesical neck as a result of years of cystoscopic and urethroscopic practice. This is no procedure for the general surgeon^(2, 5, 7).

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(For discussions turn to page 292)

TRANSURETHRAL REMOVAL OF THE PROSTATE *

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Every revolutionary procedure that departs from accepted tenets and pursues uncharted ways must pass over rough roads, and need not expect to tread the primrose path. This experience is gained by trial and error until it reaches a more or less successful goal. I believe that the procedure of transurethral resection of the prostate has made this journey and that now a

fitting and proper time to discuss its value has arrived.

Only a part of its final value can now be appraised because not sufficient time has elapsed for us to tell what the final results will be, that is, whether excision of the gland by this method will be sufficiently permanent in the end result, hence it is folly to conjecture what Time alone can answer. The most we can positively say is that the removal of small amounts by the Young

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and Caulk punch has brought good results over a very extended period, and it seems reasonable to think that much greater excisions of tissue should correspondingly offer much better ultimate results. So far as results over three or four years are concerned, it has been definitely proved that patients who had had complete retention are now voiding freely with no residual urine following transurethral.

Every urologist to my knowledge who has done over fifty cases is wedded to it and feels that it is the most satisfactory method of prostatic removal. Even the large clinics which have advocated the open type of removal are turning to it, because its outstanding results have created for it a wide demand.

I believe it to be inopportune to discuss the failures of the past, though they were the stepping stones to the present day technic. Let us rather consider what the present day experience is of those who are doing this work on large numbers of cases. In the beginning, enthusiasm caused some pioneers to elaborate on the results of removing small pieces of tissue and gave an impetus to bolder men, like Caulk, Davis, and Alcock, to attack the larger glands. Owing to their persevering efforts and courage, practically all enlarged prostates fell into the realm of this method of surgery. You have heard and will hear again men of eminence say that they have discarded open operation entirely. Accordingly it seems unnecessary to grade glands by size, all of them being amenable to this form of treatment and size alone not being a bar to the method.

Preparation for Resection

The facts that make this procedure popular are not that it is less difficult, or that less time is consumed in the operation for the reverse is certainly the case. Any skilled prostatic surgeon can remove a prostate by open operation in twenty minutes with no technical difficulty, but it takes from thirty minutes to an hour and a half to do a resection worthy of the name. The reason, then, these operators have turned to this difficult and expensive-to-the-surgeon method must be sought in the patient's welfare.

This welfare consists in relieving the patient's obstruction, and putting him back on

his feet, with the minimum of danger to his life and the minimum of discomfort during his convalescence. I believe too much emphasis has been placed upon the shortening of the patient's stay in the hospital and the reduction of expense. These two factors are consequences of the method, the operation itself resting on the firm basis of lessened danger and discomfort to the patient. The time of preparation should be the same no matter whether the open or transurethral method is used. The open operation increases the risk of shock, which destroys some of the reserve that has been so carefully built up and consequently delays recovery. The newer method is practically shockless and depletes none of the acquired reserve, affording the patient a comparatively rapid and uneventful recovery.

To accomplish this ideal, careful preparation of the patient is essential. Individual operators may vary in their routine measures, but ours are that every prostatic individual with true adenoma or carcinoma must remain in the hospital on catheter drainage at least one week prior to resection. Even in the absence of residual urine we feel that during that time we have an opportunity to study the patient's renal and vesical function. Furthermore his circulation becomes stabilized, he becomes accustomed to the urethral catheter, thereby developing an immunity in his urethra that is of paramount preoperative importance. A fair proportion of our patients carry four to twenty ounces of residual urine and have never had catheter experience. Some have enormous glands. When put on a retention catheter they develop urethral distress, catheter fever, and bladder spasms. In a few days these symptoms abate and the patient has, in truth, thus suffered his worst distress before rather than after the operation. Some patients manifest almost a phobia, so little accustomed are they to ingesting large quantities of water essential to the success of this procedure. In the preparatory week this also is gradually overcome.

It is most important that the resectionist should have a definite idea of how much gland he will remove before he begins. While the cystoscopic study offers a good clue, air cystograms to outline the amount

of protrusion of the gland into the bladder and urethrograms made with opaque solution are exceedingly helpful. These additional measures enable us to form an absolutely accurate concept of the amount of intraurethral and intravesical protrusion, especially in instances where the cystoscopic picture was distorted or cystoscopy was extremely difficult.

Routine preparation is too axiomatic to require any emphasis. But we have found in some of our cases, that where the phthalein output was consistently very low and improved only slightly even with suprapubic drainage, this becomes absolutely stabilized, after a while the patient gains visibly in health and strength, and though the phthalein never reaches the safety level for a manual removal these men stand a resection without difficulty. After his condition is stabilized — and I believe this is the most important point in his preparation — the manipulation carried through the urethra adds practically no shock or strain. In addition to these preparatory measures I favor routine vasectomy as a wise procedure.

Difficulties in Transurethral Section

However, there are difficulties in connection with transurethral resection which we must not ignore. I believe that in the operation itself the two factors which work most for unhappy results are inexperience of the operator and removal of too small amounts of tissue. I anticipate from resection recurrence of the obstruction in two to three years wherever timorous operators have removed too little tissue. This lesson was brought vividly to my mind when watching one of the great masters, Davis, resect the lateral lobes down to the capsule itself. We know the results incomplete prostatectomies by the older method when portions of the gland were left that should have been removed. All resectionists of experience have a fair number of cases to remove these very remnants. I believe that it is possible to remove the true obstructing portions of the prostate and leave a more physiologically shaped canal by resection than by open operation. As to experience, every operator gains this in the only school at which it can be gained. He must first of all be an expert cystoscopist, familiar with the visual picture of the urethra. This

comes not after hundred but after thousands of cystoscopies.

Postoperative meticulous care must be given. Granted that every bleeding point has been stopped and that indiscriminate searing or coagulating has not been done, some patients will bleed, rarely to an alarming amount, but if those are watched carefully before clots can form, choke the catheter, and distend the bladder, proper irrigation will almost always correct the situation. If not, the bleeding point must be promptly searched for and a moment's coagulation will stop it. In every instance that I have had bleeding of any importance, it was in patients that had worn a catheter less than a week.

After resection there is undoubtedly considerable edema of the cut surfaces. In some cases this subsides more rapidly than in others, and even if the patient does not void on the fourth or has some residual on the tenth day, one need not be discouraged if sufficient tissue has been removed. One word of caution. We have unhappily had a rather large proportion of bladders that were partially paralyzed by prior overdistention, in which the tone was apparently entirely lost. After every method to exclude any other cause, such as nerve involvement, these bladders occasionally required even months before regaining their propulsive power. One should therefore not promise too much too soon.

It is absolutely possible to restore a physiological channel to the urethra by resection. The old danger of hemorrhage I believe is banished. Sepsis is lessened because the surface of the remaining gland is coated with an impenetrable coagulum through which absorption takes place very slowly in comparison with the lacerated capsule of bluntly enucleated glands. I believe that in very foul bladders that do not clear with repeated irrigations prior to resection, and where no feeding source, as diverticula, stone, or pyonephrosis, can be detected, most are atonic and suprapubic drainage prior to resection is a wise procedure. Our experience has also been that cases with large bilateral lobes tend to have a more prolonged discharge of purulent urine after resection than do large medians. This likewise calls for the production of

immunity by retention catheter prior to operations.

I have purposely refrained from any discussion of the technic because I presume an academic discussion to be of little interest. One can learn more by actual observation than by theoretical discussions. Each operator has peculiar technics — and methods, but these are of minor importance. Statistics mean very little when you hear a method lauded by men who have mastered the technic, but the collective experience of careful observers leads to the following conclusions:

Conclusion

1. Practically all prostates are amenable to resection.
2. Slight canalization of the gland is insufficient in true hypertrophy, and restoration of as near a physiological path for the urine as possible must be made by removing all possible obstructing tissue.
3. Stabilization of the patient preparatory to operation is paramount, and this is best accomplished by at least a week's stay in the hospital on a retention catheter.
4. Stabilization greatly diminishes hemorrhage and sepsis and will avoid many accidents due to causes extraneous to the urological tract, as cardiac failure, embolism, or intestinal distress.
5. Study of bladder tone is of vital importance, and persistent pyuria is best treated by preliminary suprapubic drainage.
6. Skill and experience are paramount to success, and in proper hands prostatic resection is the safest and most physiological form of prostatic removal.

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Discussion

On papers by Drs. Caulk, Rolnick, Goldstein, Hess, and Grant.

Dr. Gustav Kolischer (Chicago): If I am not misinformed, Caulk was the first man to suggest combining the cautery punch with destruction by heat of those parts of the prostate that have to be removed. Like every pioneer he, of course, had to take a certain amount of abuse but, fortunately, he lived through it.

Caulk struck another keynote insofar as prostatic resection is concerned, in calling attention to the remote dangers connected with the application of the cutting current for prostatic resections, such as infarction of the heart and kidneys. The amount of catalyzation of these parts is based on two factors; one is of a physical character, and the other is the reaction of the system to the influence of this

physical factor. It is very easily demonstrated that the cautery does not actually conduct heat, at least not an appreciable amount. The range of the conducted heat in the application of the cutting current is about four times wider than the range produced by the coagulating current. This conducted heat is very easily carried off by the blood stream and no further damage is done. The damage is in the hyperplastic parts of the prostate. They are poorly vascularized so that this cooling-off process is very much interfered with. While not an immediate necrosis of the cell is produced in the area of the conducted, we find a necrobiosis, and after a few days the effects of the necrobiosis become evident.

Colyone is the hormone that excites the contraction of the intestinal muscle, and this colyone is produced within the intestinal wall. If capillary toxicosis is produced by the carrying on of this necrobiosis of the cells, when submitted to the influence of this production of heat the necrosis will stop. We have already pointed out the line of resistance within the heart and the heart muscles, and in the same way the toxins very easily produce their infarction. The same thing holds true of the kidneys.

It has to be considered, and very carefully, whether the application of this cutting current in producing these damages should not be supplanted by some other modality that will produce the necrosis that is necessary in order to remove these parts of the prostate. It is very disagreeable to the operator, and it is certainly very disagreeable to the patient, if after a perfect operation, without any technical errors, the patient dies from these remote dangers. I think it is to the credit of Caulk that he called attention to the danger that must be considered, and that must be avoided if possible.

Dr. George R. Livermore (Memphis, Tenn.): With regard to some of the points that were brought out by Dr. Goldstein, one being that he removes the catheter on the sixth day, it has been my practice to remove the catheter on the fourth day. I have felt that this is a long enough interval.

He spoke of infection, and I believe he said that 50 per cent of his cases showed kidney infection. Perhaps his reason for the six-day drainage is that he believes the longer the drainage the better the chance of preventing infection. We all know that often we get obstruction at the bladder neck and back-pressure on our kidneys, and the infection perhaps passing upward. On the other hand, I have used urotropin intravenously and if it is given twice a day it certainly does reduce the infection.

Hemorrhage should be checked at the time of the operation, and the patient should not be permitted to leave the operating room until he has only a very minimum of hemorrhage, with adequate drainage afterwards by means of a large catheter and keeping it drained. Often the patient will leave the operating room with practically clear urine, and by the time he gets down to his bed, as a result of moving him from the table to the stretcher and then from the stretcher to the bed, hemorrhage has started. If you have a well-trained nurse who will inject that bladder with a saline solution and keep

clots from forming, you will not have severe hemorrhages in the majority of cases.

Hemorrhage may occur as late as three weeks after operation. One of the urologists at home had a patient who died from hemorrhage on the sixteenth day after operation. Epididymitis does occur in that type of case. Where it occurs after the vas has been ligated it is due to the fact that there was infection in the epididymis before the ligation. As Dr. Hess has remarked, it usually doesn't amount to much, and if the testicle is supported and ice is supplied, it promptly subsides.

The dribbling that sometimes takes place after these operations is due to the fact of a raw surface in the bladder neck and to some of the sloughs that haven't come off, and to the tags of tissue. If you will irrigate and wash those patients out and tone up the general condition of the bladder, the dribbling will usually cease.

John Caulk's punch is by far the best method for relieving prostatic obstruction from carcinoma. It not only takes out the obstruction but gives the patient a clear opening to void. Diathermy and heat are recommended in the treatment of carcinoma, and we get both with the cutting and the diathermy current.

Dr. H. G. Hamer (Indianapolis): For many years it has been my good fortune to be associated with Dr. W. N. Wishard, one of the pioneers in transurethral surgery of the prostate, who, from 1890 and for a period of 20 years, used the cautery for snare and incision and was one of the first to call attention to the atrophy of prostatic tissue which follows cauterization. I have grown up, so to speak, in a favorable atmosphere towards any method calculated to relieve prostatic obstruction with a minimum of operative interference.

I need only refer to Dr. Wishard's work in the development of his perineal cautery incisor and his cystoscopic incisor (1900), the latter instrument being developed during my early association with him, to call attention to my interest in the more recent evolutions of transurethral surgery of the prostate.

In the wave of enthusiasm created by the advent of the application of the cutting current to transurethral operations upon the prostate, interesting papers have been contributed on the subject by a number of our foremost urologists, among whom may be mentioned Caulk, Davis, Bumpus, and others. These have included reports of results by the several methods of transurethral attack; namely, by the Young's punch or the Braasch-Bumpus modification, the Caulk cautery punch, and the Stern-Davis-McCarthy resectoscope. These reports have always shown a greatly reduced mortality and morbidity over that from open operation, but the figures are not representative of the total mortality since they are the results of the most skillful operators and should rightly be compared to the best series of operated cases. Other reports show a higher mortality and they are usually for the first group of cases operated, the same authors later being able to report much better results, which sug-

gests that the lowered mortality in the later cases must lie in greater experience gained by practice. These discussions do not admit of drawing definite conclusions as to the choice of instrument or apparatus, or the best method of application, etc., but nevertheless provisional deductions may be made.

The operation is one which is difficult technically to perform. The operator must be familiar with the endoscopic aspect of the area to be operated upon in its normal and pathological state. He must be experienced in the use of the cystoscope and especially practiced in the technic of the application of the resection instrument to be used.

The operation is not a "minor" operation and in no case one to be performed in the office. Hospital treatment is imperative. Preparatory and after-treatment must be given the exacting care and attention to details as for open operations. Scrupulous aseptic precautions must be maintained and the selection of anesthesia is as important as in open surgery.

The majority of our cases have been operated under local infiltration anesthesia by the use of the Wishard, Jr., novocaine infiltrator represented at the annual meeting of the American Urologic Association last June.

Cases suitable for transurethral treatment are in the first place sclerotic processes of the bladder neck, small adenomata, and carcinomata of the prostate. As to the treatment in cases of larger adenomata, no judgment can be pronounced, although it is probable that as time goes on more and more cases of the massive growths can be treated in this manner.

By the application of the transurethral therapy for patients with incipient symptoms of prostatism, more serious troubles may in all probability be prevented.

Before any final definite judgment can be pronounced we must have details of a very large series of cases so treated.

It is only by a study of such data in detail that we shall be able to form a well founded judgment upon these various methods of treatment with respect to the indications for and practical performance of them and, eventually, the permanency of the results achieved.

Some enthusiasts have claimed that transurethral resection carries with it no risk, or at any rate only a negligible one. This is an error. Any surgical procedure must entail some risk to the type of patient under consideration, not only on account of age but also of the fact that it is generally undertaken in the presence of sepsis and renal impairment. Statistics give little assistance in assessing the risk attached to any operation because the mortality rate of a particular surgeon will to a great extent depend on his selection of cases and on his willingness to undertake unpromising cases.

What can be definitely established from an examination of statistics is that the chief danger in all transurethral work, whatever the technic employed, comes from sepsis rather than from hemorrhage.

I think we have arrived at a time when sufficient reports have been recorded upon which to draw some conclusions relative selection of cases. Unqualified enthusiasm places us in an uncomfortable position when we are confronted with cases of large adenoma in which our judgment tells us that operation rather than resection is the proper treatment.

I am convinced from experience that very large growths should be subjected to open operation from the standpoint that they will be more safely cured in less time. For it is this type of case that shows a greater tendency to immediate and postoperative hemorrhage, often requires repeated resections, which in the end entails longer hospital stay and more care and anxiety than if subjected to open operation.

Some cases that have been resected subsequently require open operation either for the control of hemorrhage or for the removal of large masses of growth. On the other hand, cases treated by open operation may require resection to correct an obstruction at the vesical orifice not removed by operation. Then too, there are the cases of acute retention with infection which must be drained suprapubically for relief and in which resection is later found to be entirely adequate for removal of the obstruction; also cases of enlarged prostate complicated by vesical calculus and unsuited for litholopaxy, which can be most satisfactorily treated by resection after the stone has been removed and the bladder infection and prostatic congestion relieved by a period of suprapubic drainage. Cases of bladder tumor and bladder diverticula with bladder neck obstruction are treated in like manner. In making use of these combined methods I feel more secure, and I believe that modern transurethral surgery of bladder neck obstructions has gained a permanent place.

Dr. Albert E. Goldstein (closing): We should take into consideration that the open operation, whether perineal or suprapubic, is an operation that you can visualize. I want to emphasize this point, because the statement has been made that the open operation is not a visualized operation. This is contrary to fact, because a suprapubic or a perineal operation can be visualized just as well as the transurethral operation.

Both Dr. Livermore and Dr. Hess said that epididymitis does not amount to very much. The error made in epididymitis is that doctors merely ligate the epididymitis. That is a mistake. Merely ligating the vas will not prevent epididymitis. You must resect the vas at least one and one-half c.m. It should be recalled that Rolnick did some outstanding experimental work on animals, and he showed that if you do not remove at least one c.m. of the vas, both ends are apt to come together and unite. I believe therefore that it is of utmost importance to resect the vas.

Early carcinomas of the prostate are best handled by operative procedures rather than transurethrally. We know that early carcinoma does not start in the lateral lobe or the middle lobe. It starts in the posterior lobe capsule. Transurethral

resection is not going to remove that part of the organ. You are going to get merely a section of it. You do not know what you are doing with a cancer of the prostate. Therefore, the open operation is the only thing for such an early prostate. If you are dealing with advanced cases that is a different thing entirely. Advanced cancer of the prostate can be handled best by the transurethral method.

One of the discussants said that he thought the bleeding was due to moving the patient about, from the table to the stretcher and from the stretcher to the bed. I do not think that is the real reason why you see late bleeding. I believe the reason is because there is a difference in the blood pressure at the time the patient leaves the table and two or three hours afterwards when bleeding starts. We are all doing this under some form of caudal or sacral or spinal anesthesia, and there is a change in blood pressure between the time the patient is operated upon and the time he reaches his bed. There is a rise in the pressure, and I think that is what starts the bleeding.

Dr. Elmer Hess (closing): I may have left the impression with you that I do not believe in open surgical operations. I might state that I started doing transurethral operations with the main idea of finding out what I could do with them. I haven't any quarrel with those who believe in open surgery — none at all. I am going to do some prostatectomies when the indications are present. What we are all doing with at present I am trying to find out what the limits of transurethral surgery are, and just what we can do and what we cannot do with this procedure. The only way to find out is to use this method on every prostate until we know just where the procedure is of benefit, where it is of doubtful benefit, what class of patients should be done one way and what another.

According to Dr. Goldstein I said that the open operation is a blind procedure. I have never seen anything except a blind suprapubic prostatectomy. The perineal operation is all done under perfect vision, but when you have used a suprapubic tube in a bladder for anywhere from a week to three, four and five weeks, as it is sometimes necessary, and then pass through that hard, sclerotic, infected, infiltrated area, and tear the prostate out with your finger, and then pack it to stop bleeding — although I very seldom ever pack one to stop bleeding — I say that is blind surgery. The perineal operation is perfectly visualized. The suprapubic prostatectomy in the second stage is pretty nearly as blind an operation as anything I ever saw in surgery.

Those who were present yesterday at my clinic saw a demonstration by specimens of two individuals operated by the suprapubic route and by transurethral resection. Both specimens were equally as large, but with the former method the patient died on the fourth day and the latter, an individual past eighty, recovered in spite of an incomplete resection, became symptom free with practically no residual urine and enjoyed a comfortable existence until terminated by uremia. I attribute the latter's recovery to good nursing, an important phase in the

(Concluded on page 310)

ELECTROSURGERY — ITS APPLICATION TO URINARY PATHOLOGY *

WINFIELD SCOTT PUGH, B.S., M.D.

NEW YORK

It is an inexorable fact, that the march of progress cannot be stayed. This does not mean one must rush at every new technic presented, but one should keep an open mind until all the evidence is in. Certain principles, when applied to one type of lesion, may fail absolutely in attacking another. We must, therefore, let our appraisals be just and fair, for that which is frowned on today may be a feature of the morrow. This is well illustrated in connection with the technics about to be discussed, namely, electrosurgery.

Not long ago the writer presented at a clinical society several patients in whom excellent results had been achieved by the application of electrotherapeutic technics. During the proceedings a well known surgeon expressed surprise, as he thought electricity in surgery had been relegated to the archives of medical lore and history. Paradoxical as it may seem, the discussant was both right and wrong. He was quite correct in assuming the methods of antiquity had passed. There is, however, no nexus between that and the modern contributions of Ward, Percy, and others.

Today, we are speaking essentially of surgical or cutting currents, combined at times with coagulation. In these methods considerable heat comes into play and it is easy to raise the temperature far above the lethal range with this modality. As a matter of fact, temperatures of 70 and 80 degrees centigrade at a distance of one centimeter from the needle have been recorded. We must also think in terms of high amperage and low voltage.

Surgery, like everything else, has run the gamut from extreme conservatism to radicalism, but I believe the happy medium is found between these poles. In no other field of surgery has our transcendent knowledge conserved more tissue than in the sphere of urology. Anyone can blast out an organ, but it often takes a genius to save it. Of quite a certainty renal surgery offers a broad field for

conservative technic with as little trauma to the tissues as possible.

Let me say before proceeding any further, it is not our desire to present electrosurgery as a factor in all fields of urinary surgery, for in some spheres we have failed utterly, as you shall presently see, while in others our efforts have been rewarded with success.

In the use of the electrosurgical scalpel there is a marked decrease in bleeding usually seen in such operations as resection or heminephrectomy; also the actual sealing of the tissues greatly reduces the necessity for sutures. Over a long period of years I was rather loath to consider resection of the kidney or a heminephrectomy. However, following the work of Percy and Ward, we did over a hundred similar operations on dogs. After the successful removal of tissue ranging from small bits to resection of almost three-quarters of the organ by elliptical slicing, we were definitely convinced of the possibilities in the use of the electrosurgical scalpel. Hemorrhage was found easy to control by a coagulation clamp and a few ligations. In three of our animals, there was a persistent hematuria; in one lasting twenty days. This was the only connotation of hemorrhagic complications.

Surgery of the Kidney

To illustrate the application of electrosurgery to morbid processes in the renal organ, we submit the following cases:

CASE 1.—Mrs. R. C., white, age 41. Native of Russia.

Chief complaint: Pain in right lumbar region.

Family history is somewhat vague. Previous personal history is also vague except for one important point. About five years ago her left kidney was removed for what appears to have been a calculus pyonephrosis. To use her own words "there were a few large stones in a bag of matter." At the time of the above incident she was advised to look after herself or the other kidney might give her concern. We know only too well the verisimilitude of such a comment. Last year Mrs. C. noticed pains on the right side for the first time. These attacks were not severe but annoying; at times the pain radiated down the legs and toward the pubis.

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 14, 1933.

They recur now with greater frequency, in fact, usually every day and last for an hour or more. The urine has been a muddy white for some months, but no hematuria is in evidence.

Physical examination: In spite of her pathology, our patient is a puissant individual both mentally and physically. Heart and lungs are apparently normal and the nervous system responds quite well. The abdomen is somewhat pendulous and reveals nothing until one percusses over the right lumbar area. Here at once a series of — shall we say tonic contractions? occur and she is quite miserable. The pain seems well localized. Her urine is acid, 1.021, contains much pus and a few red cells. Blood and serum tests reveal nothing of import.

Urological examination detects practically a normal urethra and slight trabeculation of the bladder with a little edema around the vesical neck. Unable to enter left ureter, but a catheter passes readily to the right renal pelvis.

Phenolsulphonephthalein appears on the right side in about twelve minutes; the urine from that pelvis, contained but a few anatomic elements and pus cells.

Roentgen pictures both with and without injections, show a very large calculus in a kidney whose function is poor. (Fig. 1.).

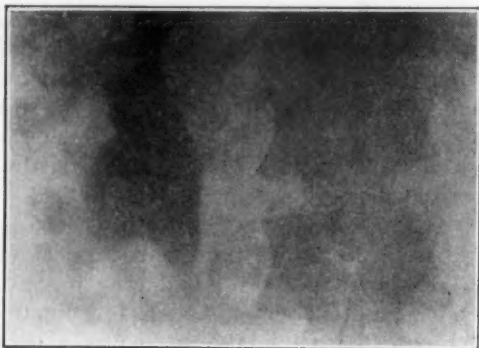


Fig. 1. Large stone in right kidney.

Treatment: Our policy as to the treatment of stone in a solitary kidney has usually been quite conservative. We advised the lady to make herself comfortable by an occasional kidney lavage with ureteral dilatations for drainage. A careful regimen was also worked out for her ways of life. Should there be evidence of impending renal block — then and only then — surgery might be imperative.

Our patient returned one month later with all the clinical symptoms of a nitrogen retention. A general pruritis, an infallible evidence of failing elimination — was notably conspicuous. There is also an asperity of a degree hitherto unknown. She is now voiding a very small amount of urine which is very pussy and extremely irritating. There is but one chance to save this woman, the block — for such it is — must be relieved.

Operation: Under a light ether oxygen anesthesia the right kidney was exposed by an oblique incision. The organ was delivered and an incision made transversely in the posterior part of the pelvis. It was quite evident at this point that speed was essential



Fig. 2. Extension of Pyelotomy incision by Electrosurgical Scalpel

and that a larger incision was necessary. The pyelotomy opening was extended with an electro-surgical scalpel, almost half way across the kidney; (Fig. 2.), and through this incision the stone was removed. There was practically no bleeding, in spite of the fact that the entire substance of the kidney had been penetrated transversely. A fascial pad was placed across the kidney incision and sewed into the capsule. No sutures were inserted in the kidney substance, and the external wound was closed in the usual way. Recovery was uneventful.

CASE 2.—Mrs. R. L., a widow, fifty-four years of age. Native of Russia — Jewish. Chief complaint: Pain in right lumbar region.

Family history: Mother and father died of senectus, in the old country, one brother of diabetes, at forty-two years; another brother in a Colorado sanitarium, presumably for tuberculosis, at twenty-three years. One sister is living but the victim of some nervous disorder.

Previous personal history: Aside from the usual diseases of childhood, she has always been well until the present illness. She has but one child, living and well.

Present condition: About seven years ago, this woman became cognizant of severe paroxysmal pain, beginning somewhere over the liver and running down the right leg. At times a similar annoyance would spring up on the opposite side; but radiating toward the right shoulder. She was examined by a skilled internist who suspected biliary calculi.

A series of gall bladder pictures, with tetraiodo-phenolphthalein sodium, definitely excluded any pathology of the subhepatic organ. At about this time, Mrs. L. began to notice a considerable amount of blood in the urine.

Complete urological examination revealed a number of stones in the left renal organ with marked disintegration of the kidney cortex and low function. According to her physician, the right kidney was normal and a nephrectomy was done on the left side.

This patient consulted us about three months ago, saying she thought a stone was now present in the remaining kidney. In fact, a calculus was seen in a skiagram made at some hospital several months ago and its removal was suggested — the patient declining. Mrs. L. now is annoyed by moderately severe attacks of pain, beginning at the costo-vertebral angle and extending to the symphysis pubis; and (note this, please) an intense itching sensation all over the body but most marked about the vulva — evidence of nitrogen retention — noted in the previous patient.

Physical examination: For the diagnosis in this



Fig. 3. Large coral stone filling right kidney.

instance we must rely on our own ingenuity. Inspection reveals a stout, well nourished woman. Heart and lungs are apparently normal and the nervous system, while organically negative, is a little high strung. The abdomen is pendulous and we do not detect anything on inspection, palpation, or percussion. While our patient scratches herself, from time to time nothing is in evidence until we reach the vulva. Here one notes a gray-whiteness which is rather suggestive of Kraurosis.

By vaginal and rectal examination we elicit little of import. One of our associates suggested a diabetic element or hyperglycemia, but this was far from cogent.

Urological: A complete inspection of the urinary ways was suggested, but declined by the patient as she had suffered greatly from her last cystoscopy. I shall not go much further into details of this case from a diagnostic standpoint except to say the non-protein nitrogen and creatinin was high.

The skiagram shows (Fig. 3.), large coral stone filling the right pelvis, all the calyces, and project-

ing into the ureter. While not clear in its general outline, the picture tells us we have a formidable task. With the blood chemistry, renal function, the skiagram, plus the absence of one kidney we are now able to present our verdict. Operation will be in order, if signs of stone block should appear. Of this there was evidence in a month.

Operation: Under ether anesthesia, the usual renal incision was made. The kidney was exposed, delivered and a rubber covered clamp applied to the pedicle. An electrosurgical scalpel was then inserted at the upper pole of the kidney and carried along the convex border of that organ to the inferior pole;

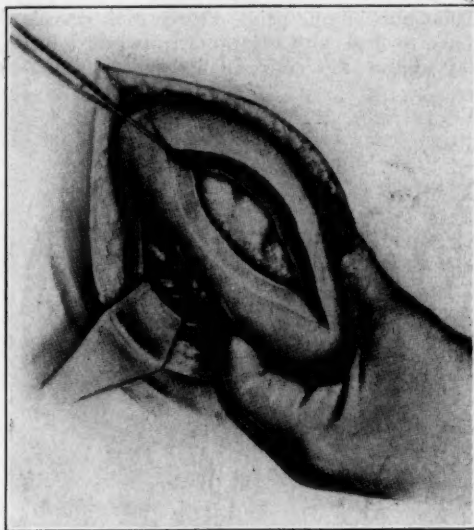


Fig. 4. Extensive kidney incision along convex border for stone removal.

(Fig. 4.), the structure was split to the pelvis and a very large calculus removed. The kidney wound was closed with mattress sutures over tabs of muscle. The patient made a satisfactory recovery.

Since the above histories were compiled we have operated on five cases of stone in a solitary kidney and resected another in which the upper pole was destroyed by stone disease. Let us hope the good fortune continues. I am presenting these cases, anticipating they will be of assistance toward the relief of suffering and the conservation of tissue.

Resection of Kidney for Solitary Cyst

Until recently this condition as distinguished from hematogenous cysts and a polycystic condition was regarded as rare.

CASE 3.—Mr. F. X. McC., white, age 55, married. Native of Ireland. Chief complaint: Pain over right renal region. For the past four years, Mr. McC. has had attacks of frequency of urination with a gnawing pain over the right kidney area. At first these crises were months apart, but gradually became more and more frequent. There has been no loss of weight or strength.

Physical examination presents nothing of interest

except the suggestion of a tumor over the right renal area. Several of us suspected a mass but all agreed there was nothing definitely palpable. Pain, however, is elicited on deep pressure over the kidney. The urine is apparently normal, as are all serologic reactions.

Urological examination: Bladder and urethra are evidently normal. Catheters pass readily to both kidney pelvis; phenolsuphonephthalein appears on the left in about three minutes — on the right side in six minutes. There is a perceptible decrease in right renal function. Repeated roentgen pictures reveal nothing abnormal.

We decided on an exploratory nephrotomy to find the cause of the pain. Exploration reveals that we have to deal with a large serous cyst which occupies almost the entire upper pole of the right

was only one bleeder of importance, which required a ligature. There were other oozing vessels but all were controlled by the coagulation clamp. The pedicle clamp having been removed, the kidney wound was closed with three mattress sutures of plain catgut and a large pad of fat placed over the line. (Fig. 6.)

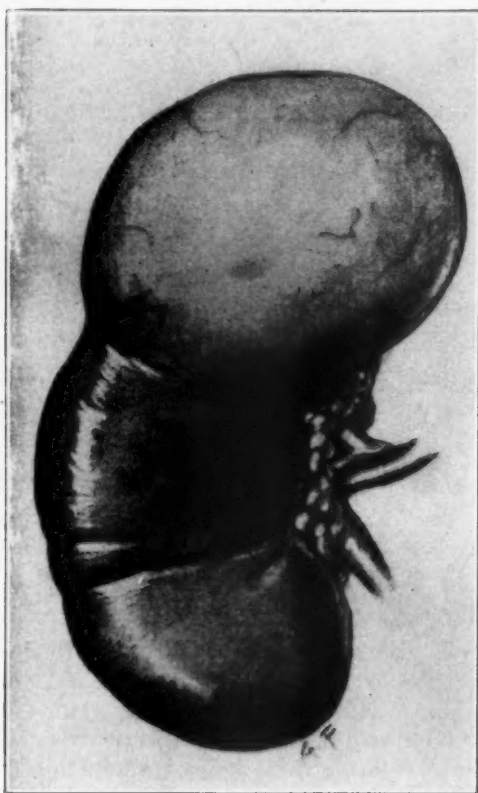


Fig. 5. Large solitary cyst of kidney.

kidney and at its base there is a considerable area of degeneration, (Fig. 5.). In accordance with our policy of never sacrificing any tissue that can be saved, we decided to resect the upper pole of the kidney. Accordingly, a rubber covered clamp was temporarily applied to the renal pedicle. An incision was made with an electroscalpel, starting just below the edge of the cyst. It was carried downward at an angle of 45 degrees toward the center of the kidney. The upper calyces were high and quite thoroughly laid bare by the incision. Here we have a cone-like opening into the renal pelvis with the apex downward. The cystic area was then removed *en masse*. Strange as it may seem, there

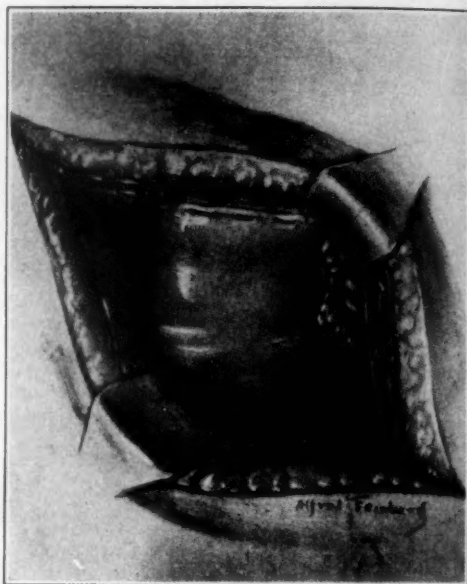


Fig. 6. Kidney after removal of cyst (shown in Fig. 5.).

This patient made satisfactory recovery. I believe the use of the electrosurgical scalpel has robbed renal resection and heminephrectomy of much of its dangers. A surgeon was not long ago challenged in a meeting as he made the statement he had been present at six heminephrectomies. The doubting young man insisted there were only six reported in the literature. A heminephrectomy in the time of Tuffier was a surgical procedure of no small consequence and far be it from me to say it is not today. Electrosurgery is here opening up new avenues for attack on disease.

Cancer of the Bladder

It is fortunate that bladder cancer can be detected early. In spite of this, during the past year we have noted more cases who have procrastinated than before. We can conceive this as related to the present economic difficulty, for most surgery today is of an emergency nature.

In the past few years there has been a tendency toward radical surgery in the treatment of bladder malignancy. We say no good can come of it. If one feels that fairly large resection is necessary, well and good. If the

neck of the organ and the trigonal area are involved, the problem is indeed difficult.

Only recently I heard cystectomy being referred to as a lost operation. Would it were misplaced indefinitely. We are even willing after a considerable resection to transplant a ureter into the bowel in a limited group of cases, but we cannot boast of our end results.

What, then, shall we do in the presence of this trying situation? Much is read not only in the advertising material of radium institutions, but in quite a few surgeons' records about the wonderful results achieved with radiotherapy. While I do not like to doubt those of unquestionably large experience, I remain skeptic.

Our results in the transurethral treatment of cancer by radium have been unsatisfactory and with other methods none too good. I believe our best achievements are obtained by opening the bladder above the pubes and treating the growth directly by surgical diathermy. Bumpus tells us the degree of malignancy in tumor is the greatest factor determining the final result of any type of therapy. This may be true enough, but few can determine the degree of malignancy.

Diathermy

Surgical diathermy is an excellent modality that had a poor record at first, but one which is now taking its proper place, as evidenced by a few of 120 cases of bladder cancer we have now treated by diathermy.

CASE 4.—J. N., white, age 49. Examination reveals a large sessile growth extending from the posterior wall of the bladder well up into the dome. The bladder was opened in the midline and a good exposure of the organ made. In appearance the growth noted on opening the viscus was practically the same as found on cystoscopy. The tumor mass was severed with the electrosurgical scalpel and the remaining base thoroughly coagulated (an electrode about the size of a penny being used), until it was a white, charred mass. These procedures take time and this one lasted almost an hour. The patient has made a good recovery.

CASE 5.—This patient had something of unusual interest. Mr. G. G. is a Greek, age 57, who has traveled extensively and spent much time in South Africa. For at least five years he has been under treatment for schistosoma of the bladder. Regarding this diagnosis there cannot be the slightest doubt. I saw him shortly after he came under observation by a physician of extensive experience in tropical diseases. There was also a perineal sinus through which urine at times emerged and in which the bilharzia were often found.

During the year 1929, the patient was doing well under intravenous treatments of tartar emetic. Sudden attacks of dysuria, urgency, and hematuria of

which he had been free of for some time, came on again with considerable violence.

Cystoscopy revealed a very large mass around the right ureter. A remark was made to the effect that if this man did not have bilharzia, I would say we had a massive sessile carcinoma. Biopsy confirmed the diagnosis of papillary carcinoma. We should have said also, no parasites had been found for the past six months. This, then, was an undoubted carcinoma possibly incident to the prolonged irritation of parasitic disease.

On opening the bladder the growth appeared much more extensive, but while in close proximity to, it did not involve the ureter. The projecting mass was removed electrosurgically and its base thoroughly coagulated. We were not afraid to go a little beyond the growth. Those who have noted bleeding from the bowel after the use of the actual cautery in the bladder, will be pleased to hear that in our series of 120 patients treated by this method, we have seen no intestinal bleeding.

CASE 6. Mr. I. L., a chemist, age 61. Complain of attacks of hematuria for the past two or three years. At times the bleeding lasts for one or two weeks, again the duration may be of one day only. Of late he has lost so much blood that he is impoverished. An examination of the bladder reveals a very large mass, suggesting multiple pedunculated papillomata around the left ureteral orifice. A catheter passes readily to the pelvis of the right kidney, the function of which is good. No catheter passes on the left and we are in doubt as to just where the opening is. A biopsy through the cystoscope gives a diagnosis of papilloma.

We suggested to this patient that his bladder be opened. At operation the growth was found to involve the ureteral orifice and the ureter for a distance of about one inch. The tumor and surrounding areas were thoroughly treated with the electrosurgical scalpel and a diathermic electrode about the size of a penny. By the time this was completed, a frozen section report was back on some of the growth we had removed and the diagnosis was repeatedly given as carcinoma. We then resected a large area of the bladder and ureter, transplanting the stump of the ureter close to the dome of the bladder. Recovery was uneventful.

We have reported only a few cases of bladder electrosurgery in the treatment of malignant disease; but they will, I believe, suffice to show its value.

In our clinic, many cases of bladder tumor have been treated by electrocautery loop with apparently good results, but of late it was given up. When one has a formidable antagonist, the electrosurgical scalpel and broad base coagulating electrodes are our best instruments for consideration.

A Waterloo at the Vesical Neck

I will sketch a few of the high lights of our rather sad experience. We tried to tell this story once before, but it never was permitted to reach printed pages of the great journals. It is difficult for me to escape the conviction it is my duty to tell of failures along with successes.

In spite of certain basic training in the

morbid anatomy at the vesical neck, I had to change my mind several times regarding it. Unfortunately, a very large number of persons are still groping in the dark.

Let us, for the sake of discussion, say obstructions of the vesical neck are due to two lesions; first, median bar or chronic inflammatory condition, with prostatic atrophy, and second, hypertrophy of the prostate, with definite adenoma formation. I would like to add that in my experience the bar is unusual or my eyesight is bad; having gone through six months service in a large institution without seeing one. However, in those visualized we have had excellent results with electrosurgery, for which all of the first class instruments seem to be of equal value.

It had always been my idea that if an adenoma presented as a prostatic hypertrophy, there was no use taking out a piece of it either by electric or other means. We do not remove a portion of a fibroid uterus or breast tumor. I was loath to take up the modern transurethral technic championed by my friends.

Just think of the high mortality in prostatectomy, wrote one surgeon; practically every other case a death. This was a revelation to me as we had just gone through a series of forty-two suprapubic and perineal prostatectomies with no mortality. Then it was claimed that the patient is saved a long hospitalization. He arrives at the infirmary — is given a spinal, and in two days is back home.

The ease with which electrosurgery would clear up these prostatics, drew recruits from all fields of medicine and I believe when the facts of this epoch become known the mortality will be appalling!

If there is one class of patients in whom a violation of basic principles is fraught with danger, it is in these with enlarged prostates.

Cases Observed

Tremendous publicity has associated itself with transurethral prostatectomy and as a result there has been no dearth of clinical material. It has given us an opportunity to carefully study 125 cases in our own service and that of associates. Following a few misfortunes, the dictum was issued that the transurethral method be done only by the expert operator. All of the cases in our list were cared for by experienced surgeons.

The youngest patient in our series was sixty-one and the oldest eighty-five. Seventy per cent were over the same number of years. All were those who had experienced urinary symptoms over long periods with typical enlarged prostates. In but five was there an absence of residual urine; yet these were among the most pronounced hypertrophies. In eight of the series, carcinoma was noted in microscopic sections.

Previous operations: In eight of the cases in this group there had been a previous operation with the resectoscope or similar instrument. One had been subjected to a punch operation. Every one of these unfortunates stated he had been relieved for a while, but in about three weeks to a month there was a gradual return of symptoms. In one instance the first evidence of recurrence appeared to be a sudden and complete retention of urine.

In all cases we had under observation the usual preoperative technics were carried out; in other words, they were prepared for a so-called radical prostatectomy. In all instances spinal anesthesia was used.

Results

It is true that 125 cases is no great number upon which to base a definite opinion, although it would appear others are satisfied with less. As this contribution is in the nature of a preliminary report, details are avoided.

In our group, I regret to say, there were twenty-one deaths; a mortality not exceeded by the ordinary prostatectomy. We have had several severe hemorrhages of a degree greater than so far reported, although there was but one death from that cause. Probably he would have died anyhow, as prompt measures were taken through a suprapubic opening to no avail. All other bleeders were readily controlled.

The comments on our hemorrhage cases have been quite interesting, many being unable to understand why I should have been so annoyed. "I have seen you do a kidney resection and control the bleeding with the coagulation current," said one surgeon, "then why should you not apply the same principle in the prostate?" All I can say is, coagulation does not seem to work as well for me in the gland as it does in the kidney. One sleeps much easier after having used a good pack or a bag. One should be ready for a supra-

pubic cystotomy to check hemorrhage, if this opening has not already been made.

Infection accounted for fifteen of the fatalities in our list. Ascending infection with an acute suppurative pyelonephritis, either unilateral or bilateral, was invariably noted. In two cases there was marked suppurative perivesiculitis; very similar to pelvic cellulitis of the female. An endeavor was made to drain these cases through the perineum; but definite pyemic symptoms soon appeared. In one case of ascending infection, a bilateral decapsulation was done on the advice of eminent colleagues, and this may have hastened the demise although there was little shock. While preparing this brief report, we saw one case in the City Hospital with a marked periprostatis accompanied by separation of the pubic bones.

Incontinence of urine seems to be a very annoying condition, and in our list there are nine in whom it persisted from one to four months. We were fortunate, as many seem to be permanently disabled. One case cleared up after a radical prostatectomy.

Anuria accounted for four deaths. As usual they were in the younger members of our group, in whom we had every reason to expect a good recovery. In our hospital experience, the best results are usually obtained with cases we regarded as prognostically bad. Pneumonia accounted for one of our deaths in a cardiac patient whom we had to give some relief from his prostatism.

Subsequent Operations

Of those who did not figure in the mortality list, twenty-nine have since been subjected to radical prostatectomy. This is a long story and alone contains many points of interest, to be treated at a later time. Suffice it to say, the results of the transurethral sections were unsatisfactory. If our modern concept of the enlarged prostate being an adenoma, is correct, how can anyone expect the partial removal of a tumor to be helpful?

Complications

Epididymitis occurred in seventeen cases in spite of bilateral ligation of the vas. In the discussion of one of my papers a physician said he had never seen the epididymis swell after tying of the vas, which is marvelous — if true. Aside from the condition mentioned, there was little else of interest.

Revision of the Bladder Neck

In connection with this subject I cannot pass over the new architecture. Repeated invitations finally found me visiting the shrine of bladder neck revision. In this group I did not see a single case of real prostatic hypertrophy. Some were cases of chronic surgical prostatitis, but most of them would have responded to that excellent instrument, the Kollman dilator, without surgery. I mention this revision technic as nothing more or less than a very dangerous stunt. You will hear considerably of it before long.

Hospitalization

One of the big claims made for the technic under discussion is the brief period of hospitalization. In these days of world sickness, it makes a big appeal, but is it quite fair? In the old days when we did internal urethrotomy, I kept the patients in bed for a week; and there was but one incision. When we do a transurethral prostatectomy, new avenues in which there is a possibility of infection are opened up just as they are after a uterine curettage. Most surgeons want their patients to have proper rest after uterine surgery and certainly the prostate is the analogue of the uterus. In my years of battle with the prostate I have come to respect it and am certain that after an assault upon it, the patient should receive adequate rest.

104 East 40th St.

Discussion

Dr. S. A. Beisler (New York): Physical therapeutics has, in recent years, contributed to the urological armamentarium the so-called electric knife and the various equipment necessary for transurethral prostate resection. In the latter part of the 19th Century Bottini introduced the cautery knife for removal of prostatic tissue through the urethra and in 1910 Beer gave us the diathermy fulgurating current for use in transurethral and transvesical destruction of neoplasms of the bladder.

Pugh has described the electric knife with its high frequency cutting and coagulating current and how it reduces the incidence of hemorrhage in nephrotomy for calculus and partial resection of the kidney. We have used it on a number of nephrotomy cases at the Squier Urological Clinic for removal of one or more calculi with practically no bleeding. We have not had a case where partial nephrectomy was indicated after having the appropriate equipment but can well understand why the electric knife would be of distinct advantage. I would like to ask Dr. Pugh whether he uses the electric knife throughout, that is, in the preliminary incision and exposure of the kidney. We have abandoned its use in exposing the kidney as all our

wounds have broken down, some sloughed extensively and several had to be excised and a secondary closure done. The sloughing area involving mainly the skin and subcutaneous tissue, and is apparently due to sealing of the lymphatics. The muscles and fascia apparently heal well. Kidney rack specimens of urine after nephrotomy have been grossly free of blood throughout the post-operative period.

Transurethral prostatic resection still has its adherents and opponents. Irrespective to which class one belongs, one must admit that it is of distinct advantage in treating about 8 to 10 per cent of bladder neck obstructions namely:

1. Fibromyomatous hypertrophy with contracted bladder necks.
2. Median bars.
3. Middle lobe obstruction in the young man.
4. Interureteric prominent bars with a pouch for residual urine behind the bar which prevents clearing up a cystitis.
5. Removal of the occasional recurrent lobule after prostatectomy or the occasional tab of prostatic capsule which acts as a foreign body.
6. The terminal cases of carcinoma of the prostate in which the instrument can be passed are frequently given sufficient relief so that the permanent cystostomy tube is not necessary.

As Pugh has brought out, the majority of prostatic hypertrophies are adenomas and there is a surgical principle, namely, that without complete removal there will be recurrence. Another pertinent question which years alone will answer, namely: Will the incidence of prostatic cancer increase? The preliminary reports of most individuals were not as good as their later reports. Must 50 to 100 patients be literally sacrificed as poor end results in the training of every future urologist? We must admit it is a one-man procedure and cannot be taught to an onlooker. The over-enthusiastic should be tempered. The level-headed urologist will not bring this method forward as a prophylactic means against later trouble. Occasional routine examination of men in the prostatic age is desired but to recommend this procedure in the absence of symptoms or in the presence of mild symptoms is unwise. Every urologist numbers among his patients two large groups, namely, the symptom-free man with a huge prostate and the other with a large or small one with or without a low-grade infection who has occasional periods of increased frequency due to congestion which readily responds to one of a number of conservative means of therapy. Both these groups run little or no residual. They go on for many years with relatively no discomfort. Would it not be folly considering our present knowledge, to perform an electrical revision? If late hemorrhages are common, is not the hospitalization period too short? We have kept the greater number of our electrical revision cases in the hospital 21 days. To do this as an office procedure would be folly. To those who are dividing the procedure in adenomatous cases into 2 or 3 stages, nothing is gained over prostatectomy where all is removed. Likewise in cases requiring a first stage cystostomy drainage period other things being equal why do an electrical revision in preference to prostatectomy?

Mortality and complications do not go with our whims and fancies and it is our belief that they will be just as great if not greater in electrical revision if it is used in all cases. A properly trained urologist can pick 100 successive cases and have a mortality of $\frac{1}{2}$ to 2 per cent. Our responsibility, however, goes much further than this, even at the risk of a greater mortality in order to bring back to society in a proper condition, those cases which we may aptly classify as wrecks, even at the expense of a higher mortality. These cases are all individual problems as to preliminary care, type of anaesthesia and operative procedure.

Reasonably early prostatic malignancies and cases without demonstrable extension or metastases have best responded to either perineal or transvesical removal or to implantation of radium needles by both routes. Prostatectomy and radium simultaneously should be avoided as in our experience it leads to marked necrosis and its attendant long period of discomfort to the patient. I do not see the rationale of the use of electrical revision in these cases. It is of distinct advantage if it can be used in terminal cases to avoid the odorous permanent cystostomy tube.

During the past two years a certain percentage of our prostate cases have been subjected to electrical revision when the indication for this procedure seemed definite. However, although some results were satisfactory, the larger portion left much to be desired particularly in the adenomatous hypertrophies a number of which were eventually prostatectomized. No fatalities have occurred in cases operated on by any member of our staff with the exception of one case where the clinical diagnosis was carcinoma of the prostate. Thirteen days after the resection he had a sudden hemorrhage into the bladder. I happened to be on the ward at that time and although he was not my patient I did an immediate suprapubic cystostomy for control of the hemorrhage. Nevertheless in spite of a transfusion the patient died five days later of sepsis and accounts for one death in 60 cases of our series. One of the main objections is the high incidence of infections in previously uninfected cases and its persistence, a year being not at all unusual. Is it because we are chipping off pieces of tissue in infected adenomas? The staff of the Squier Urological Clinic is keeping an open mind and continuing its use.

In dealing with malignancies of the bladder one must use that which offers the best end result for the particular case. At the Squier Clinic we definitely believe our best results are obtained in segmental resection of the bladder. If the neoplasm extends into the bladder neck only radium or diathermy can be used. We have used both and believe radium needles planted transvesically offer the best result. We have not encountered the reported serious ascending infections of the kidneys. Malignancies are peculiar in their response to treatment. Every urologist can quote a number of examples of cases considered inoperable which have responded to some form of inadequate therapy. The microscopists' classification of degrees of malignancy has not been too accurate in correlation with the clinical course where an adequate follow-up system is available.

RELATIVE INFLUENCE OF EXTERNAL AND BODY TEMPERATURES UPON THE HEART *

SIMON BENSON, Ph.D.

CHICAGO

This report contains one phase of the results so far obtained in our present study on Physiological Reactions to Therapeutic Measures. The results are of sufficient interest, we believe, to warrant a preliminary report. Detailed description of the technic and apparatus employed will be presented in a future, more complete, report. Suffice it, therefore, to merely state that the records presented here were obtained as follows: The body temperatures by a self-recording rectal thermometer (Brown potentiometer); the bath temperatures by self-recording thermometers (American Recorder for the water baths, and a Brown Recorder for the hot air baths), these being checked, in each case, with a mercury thermometer. The respiratory- and heart-rates were recorded continuously on a kymograph; the former by a pneumograph-tambour arrangement, and the latter, from the radial artery, by a sphygmograph-tambour arrangement. Hence, the records, as far as *temperatures and rates* are concerned, are entirely automatic, and consequently, to that extent, mechanically correct.

Early in our work we were surprised to find that after heat treatments — radiant heat, hot air, or hot water — the heart rate would drop back towards normal almost instantaneously, while the body temperature would either remain above normal, or, in some cases, even continue to rise for quite some time. This appeared to be *prima facie* evidence to the effect that the heart rate was relatively independent of the body temperature, as such; and that it is affected chiefly by the temperature of the *skin*, or other subcutaneous structures sufficiently superficial to be directly affected by the

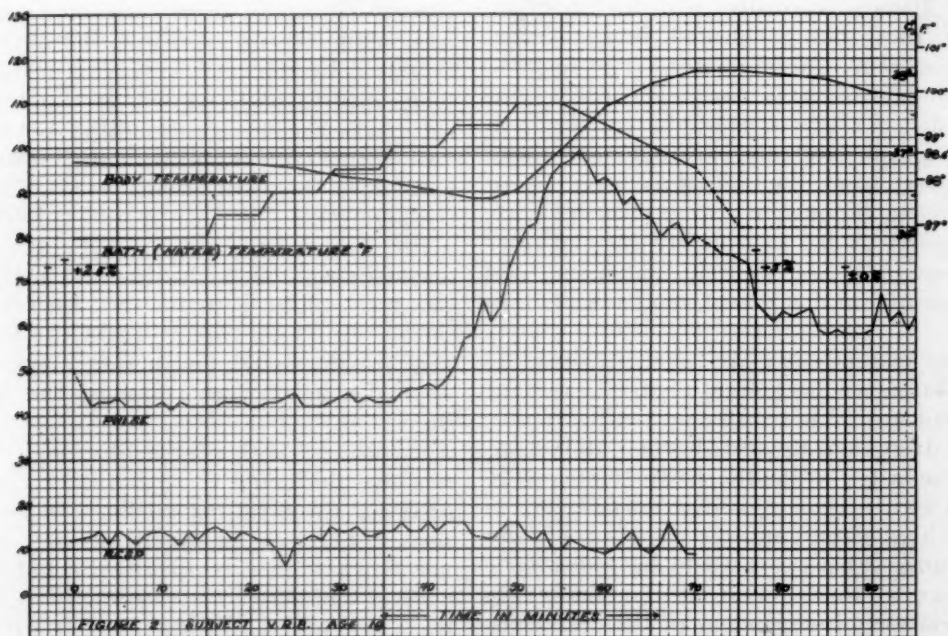
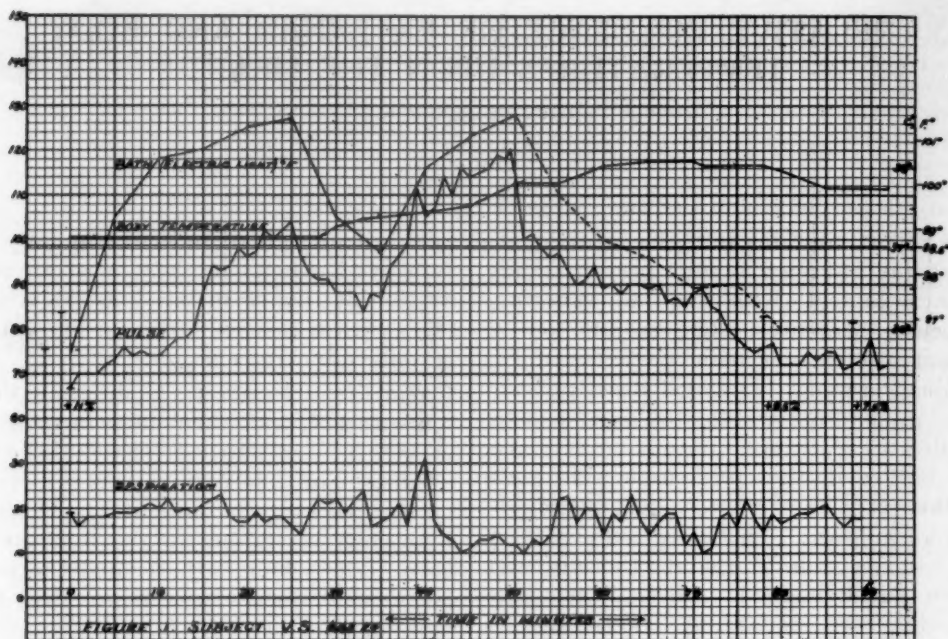
heat when applied, and consequently quickly cooled when the heat was turned off. With this theory in mind, we devised new tests with which we hoped to more definitely determine its validity.

Our first scheme was to fluctuate the bath temperature, and then determine whether or not the heart rate followed those fluctuations. The fluctuations were to be sufficiently rapid and frequent to prevent simultaneous variations in the body temperature. The water bath seemed the most efficient medium available to produce and control such temperature fluctuations upon the skin, especially in controlling the cooling phase. However, there were also some objectionable features: First, the bath could be raised to only a few degrees above body temperature; and, second, in cooling the bath with the desired rapidity, it would be necessary to lower the incoming water, and sometimes the bath itself, *below* the body temperature. This, we feared, might bring forth objections as to the accuracy of experiment on the basis that the body temperature might actually be lowered and raised with such rapidity that the inherent "lag" of the rectal thermometer would prevent the proper recording of the fluctuations.

To escape both of the aforesaid difficulties, we decided to use hot air or radiant heat as the heating medium in our first tests. This would enable us not only to use much higher temperatures, but also to subject the skin to quite extensive fluctuations in temperature without permitting the temperature of the bath to even closely approach that of the body. For example: A temperature of 140 degrees F. can easily be tolerated by the body, when the medium is hot air. After such a temperature has been applied for some time, the temperature of the bath may be brought down to 110 degrees F., thus giving a comparatively effective cooling to the skin; but by no line of imagination does it seem possible that

* From the Physiological Laboratory and Department of Physical Education, University of Chicago.

* This work is aided by the following companies who are furnishing most of the apparatus necessary:
Consolidated Ashcroft Hancock Co., Inc.
The Brown Instrument Company.
The Burdick Corporation.
The Crane Company.
The Powers Regulator Co.



FIGURES 1 AND 2

Key:

Body temperature is to be read by the scale to the right; the rest of the graphs—bath, pulse, respiration, and metabolism—by the scale to the left.

Metabolism is indicated by the four perpendicular lines:

No. 1 (reading left to right) represents the individual's theoretical B.M.R.—calculated.

No. 2 represents the metabolic rate obtained just before the start of the experiment and is an average of two runs.

No. 3 represents the metabolic rate obtained after the test, at the time indicated (in Figure 1, the 78th minute).

No. 4 represents metabolic rate at the time indicated.

The short horizontal line used as starting point for the pulse and respiratory graphs, represents the individual's normal rate, and is an average of two minutes or more, just before the start of the experiment.

The dotted portion of the graph indicating the bath temperature represents: In Figure 1, the temperature of the light cabinet after the current was shut off (the subject remained in the cabinet); in Figure 2, the temperature of the air next to the skin, as the subject lay wrapped in blankets after being removed from the water bath.

(Concluded on page 308)

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EDITORIALS

BERNHARD'S EPOCHAL CONTRIBUTION TO SURGICAL TUBERCULOSIS

The healing power of Nature is nowhere more brilliantly demonstrated than in the revolution brought about since the employment of sunshine and open air in surgical tuberculosis. One need only recall the extraordinary operating tendencies and the consequent mutilating results, the disheartening morbidity following even the most promising of medicinals, to realize the great benefits that have accrued to humanity since the introduction of climato- and heliotherapy into this field of practice. Other names loom large in this domain, but none has so cogently correlated the effects of high altitude environment and sunlight, nor inspired a more extraordinary group of disciples than Oscar Bernhard. It is high time that scientific medicine recognize in him the leading pioneer of modern heliotherapy and accord him the belated honor due him for his fifty years of service in this important field of medicine.

With the advantage of perspective one can now look back to that period when operative furore following the introduction of the aseptic method in surgery gave rise to an enthusiasm which had its repercussion in the failures following extirpations, resections, arthrectomies, and amputations. No less an authority than Esmarch recognized the futility

of this trend and began to look for support in other directions. According to Bernhard, v. Czerny voiced his dissatisfaction with the trend in this type of surgery and "looked for an ally who could save it many a hopeless or dangerous intervention, and make secure some laboriously attained success."

The year 1886 apparently was the propitious period for change. Unencumbered by the prestige of surgical experience and with the optimism that only youth can display, Bernhard, then just entering upon the practice of medicine, began to emphasize the supportive measures of tuberculosis treatment — sunlight and climate — and to retire surgical interference to the background. Since then, his keen observations have gradually built up an authoritative structure, the like of which has not been duplicated in physical medicine. His paper elsewhere in this issue is but a modest resumé of nearly five decades of personal effort. And while there is more than a modicum of truth in the observation that "we operate but God cures," it must nevertheless be apparent that the cure is always proportional to the intelligence of the operator. Thus it was no mere chance adventure that led Bernhard, in 1902, to expose an Italian patient, moribund from inflicted knife wounds, to open air and sunshine, and to demonstrate the striking results obtained.

Aged and respected as sun therapy has been, neither the ancients nor the peoples of any other period since then have so concisely summarized the beneficial value of this agency as Bernhard. While it is true that many of modern observations find their counterpart in the documents of ancient writings, the outstanding difference has been in the interpretation of these findings — the ancients attributing them to supernatural causes, the moderns to natural. The sun-worship of the ancients has been replaced by the sun-culture of the moderns, and to make the inexplicable explicable has been the motif of modern heliotherapy. To demonstrate the correlating influence of the healing power of sunlight, the stimulating effect of climate, and the nutritional value of rational diet, has been the objective of Bernhard and his school of thought.

Contrast the splendid results obtained under this regime with that pictured by the surgeon Volkman. The latter saw in his dreams a world of crippled children hobbling and groveling on resected limbs and serenading him with discordant wails. Heliotherapy as practiced by Bernhard has demonstrated the curative powers of Nature under intelligent direction. Cripples and even the most advanced types of surgical tuberculosis have been released to the world as rejuvenated and reconstructed individuals. Of his first thousand cases of surgical tuberculosis so treated, 858 were cured, 120 were improved, 14 were unimproved, and 8 died — a mortality rate of but 1.5 per cent.

When one compares these statistics with those that have preceded the scientific advent of heliotherapy, or the current statistics of other methods of treatment, Bernhard's results appear to border on the miraculous. When one also considers that within the group of 2,500 cases mentioned in the paper under consideration are included functional, physiological, and organic restoration of such diversified localizations as skin, bursae, glands, bones and joints, genitourinary, serous, intestinal, and other parts; and that favorable results were obtained even in tuberculous spondylitis and tuberculous peritonitis, one is tempted to somewhat change the classical aphorism of Hippocrates; namely, "What medicine cannot cure, iron can, what iron cannot cure, fire can, and what fire cannot cure, heliotherapy and climatotherapy can." This we would inscribe on the escutcheon of Oscar

Bernhard for his epochal contribution in the field of surgical tuberculosis.

ELECTROSURGERY OF THE PROSTATE

The classic operation of perineal and suprapubic enucleation of the prostate has become standard in urologic surgery. The comparatively high mortality rate and certain disagreeable phenomena in the train of prostatectomy, have placed that operation in the category of formidable procedures with functional results that left much to be desired in very many instances. Under such conditions it was natural for progressive urologists to seek modifications in technic or new procedures with a view of enhancing the immediate and later results. Bottini's method, introduced late in the last century, to burn endovesically a channel for the free passage of the urinary flow, was the first attempt to obviate radical surgery of the prostate. Its failure of widespread adoption was due to the crudity of the technic rather than the underlying idea.

It was natural that with the development of d'Arsonval's epochal discovery to a state of clinical applicability in a surgical sense, urologists were quick to utilize the desiccating and coagulating effects of the high frequency current for the control of hemorrhage emanating from vesical papillomata, and for the destruction of the growths by fulguration. Approach to the growth being accomplished with the visual aid of cystoscopy, it needed but the apparatus providing a high frequency current for surgical dissection to enable a few pioneers in urologic surgery to develop a method of intravesical surgical attack of the prostate, resembling in principle the Bottini operation but in reality technically different from that obsolete procedure. As a result we have today what by common consent is known as Transurethral Electrosurgery, as an operation intended to rival if not to replace classic prostatectomy.

Not unlike the history of most important innovations in medicine, transurethral surgery is too new a procedure, too complicated both in technic of execution and postoperative effects, not to have a stage of transition. History repeats itself, for the essential problems of transurethral surgery, especially for the relief of prostatic hypertrophy, are far from being decided unanimously by leading urologic surgeons. We again behold the spectacle,

known to us from history, of authoritative opinions expressing opposite valuations of the method. On one hand we have the voices of enthusiasts who would fain regard transurethral surgery as the final solution of the problem of the hypertrophied prostate, and as many who take the opposite view; namely, that the problems are not only not solved but rendered more serious than was the case in the past. Under such circumstances the general practitioner, who, in the last analysis, is the first adviser of the concerned sufferer, finds himself in a quandary which operation to suggest. A review of the situation from his point of view is, therefore, timely.

At the last session of the Congress of Physical Therapy was held a symposium on this very subject, which we publish in this issue. The men who have contributed to it represent the highest type of urologic skill and acumen. Considering the diversity of opinions held by them, opinions based on clinical experience in which the question of individual skill need not be raised, an impartial analysis should prove illuminating and possibly serve for our guidance.

Perusal of the several articles forces on our attention first of all the question whether the use of the high frequency current has proved itself as effective in transurethral surgery as it has in other surgical operations. We must not overlook the fact that the extirpation of a tumor anywhere on or in the human body outside of the urinary bladder can be removed electrosurgically without the side-effects created by the current in that viscus. To begin with, the transurethral operation is performed under water, and the heating effect of the current has been known to cause veritable explosions which can be overcome not only by a refinement of technic but also by better apparatus on the market. Again the deep effect of the high frequency current, easy to control almost in all general operations nay, often desired for their greater effectiveness, may prove detrimental under the histologic conditions prevailing at the neck of the bladder. It is because of these facts that the instrument devised by Caulk, which affords a great improvement of the so-called punch operation, must be regarded as perhaps physically better suited for removal of vesical portions of the prostate. We have here, in other words, a case of conductive against convective heat production.

Without entering into a discussion of the

relative merits of the galvanically heated instrument or a suitably constructed electro-tome, the general impression one gains from a perusal of the symposium is, that either appliance yields technically good results in the hands of men, who by actual trials have acquired mastery over the difficulties, so that it will in all probability be a matter of personal preference whether an individual operator uses the high frequency current or galvanocautery excision. Of greater importance to us is the problem of mortality. Here, too, we are confronted by a statistical material, the interpretation of which is not free from difficulties. Only by a detailed study of the several thousand cases that have been treated could one arrive at a fairly reliable conclusion. We must not forget that prostatic obstruction does not occur in young and robust individuals, but in men who have reached an age when their power of resistance is diminished, to which should be added that when they seek medical aid they have already infection of the bladder and damaged kidneys. But what does strike us as a hopeful note is the fact that in cases in which prostatectomy would have been a grave risk, carefully performed transurethral resection has resulted in cures in the majority of instances.

The after effects of transurethral surgery do not appear to be more favorable than with classic prostatectomy, the best being in cases with median bar obstruction. No matter how enthusiastic some of the operators seem to be, there remains no doubt that transurethral surgery still is a formidable procedure, requiring much preparatory care, special technical skill, and rational postoperative management.

Certainly prostatectomy cannot possibly be replaced, especially in the large hypertrophies, if for no other reason than the chance afforded by it to rid the sufferer from a growth that may already contain a malignancy, which cannot be detected clinically. It goes also without saying that the indiscriminate application of transurethral methods will in the end defeat its own purpose. It is only by a careful selection of individual cases showing definite indications that transurethral surgery will celebrate its future triumphs. As Rolnick so aptly put it, resections should be limited to bars, contractures, and minor degrees of hypertrophy. This, he estimates, to amount to about 30 per cent of all cases of bladder neck obstruction — a great field for transurethral surgery.

Relative Influence of External and Body Temperatures Upon the Heart

(Continued from page 304)

the body as a whole may lose heat, and experience a lowering in temperature, while surrounded by air at 110 degrees F.

The reactions obtained from numerous experiments, along the line indicated, all substantiate the theory advanced: That the heart rate varies as the temperature of the skin and closely related structures, and not as the temperature of the body as a whole. Figures 1 and 2, both of which are largely self-explanatory, present graphically the results obtained from two of our experiments:

Discussion

In case of Figure 1, the similar and simultaneous fluctuations in pulse rate and bath temperatures strongly indicate a control of the former by the latter; and judging by the body temperature curve, there appears to be no direct relation between it and the change in heart rate. It seems fair to assume, however, that the skin temperature does undergo fluctuations similar to those of the bath — although not quite so extensive, perhaps. At present we are inclined to believe that it is the stimulation of the temperature spots — with a subsequent chain of reflexes which terminate in the heart accelerator or depressor nerves — which causes the variations in the heart rate under those conditions.

Figure 2 indicates that stimulation of the cold spots under normal conditions produces a lowering of the heart rate — in this case from 50 to 42 beats per minute — and the interesting feature that the rate does not again increase until the temperature of the bath rises above that of the normal body temperature. The pulse rate of 67 in the subject V. S., and 50 in subject V. R. B. are normal pulse rates in healthy individuals: V. S. was a member of the Varsity football squad, and V. R. B. is a swimmer. A swimmer was chosen for this particular experiment in order to eliminate as much as possible undue reactions likely to be

created in individuals not accustomed to water at the temperature employed. The point of greatest interest in this figure is, we believe, to be found between the 55th and 60th minute: 1, the body temperature rises practically 1 degree F.; 2, the bath temperature and the heart rate are both decreasing; and, 3, the heart rate begins a sharp decrease in rate with the water bath still at 108 degrees F.

Conclusions

On the basis of the results so far obtained, one might draw the following tentative conclusions:

1. Under our experimental conditions:
 - (a) The heart rate varies directly as the temperature applied to the skin.
 - (b) The almost instantaneous response of the heart to the changes in the bath temperatures, indicates that it is a reflex action — probably initiated through the stimulation of the nerve endings (temperature spots) in the skin.
2. Increase in body temperature, as such, produces an increase in heart rate mainly insofar as the circulating blood heats up the nerve endings (hot spots) in the skin.
3. In case of fever, the heart rate may to a great extent be controlled by keeping the skin cool (method limited by the pathology involved).
4. Artificial fevers may be produced — *theoretically* at least — without increasing the heart rate to any great extent. Any method by which sufficient heat can be introduced into the body while the skin is kept comparatively cool should accomplish such result.

* * * * *

The writer's personal hearty thanks as well as volumes of credit in general are due to Professor A. J. Carlson, Chairman, department of physiology, whose untiring efforts, constant support, and helpful criticism have made the work possible; also to Athletic Director T. N. Metcalf whose co-operation enabled us to do the work in the Department of Physical Education.

SCIENCE, NEWS, COMMENTS

Dr. Clark Resumes Original Field of Practice

Dr. William L. Clark, 1930 Chestnut Street, Philadelphia, announces that his original field will henceforth be resumed to include the treatment of conditions wherein such adjuvants as electrosurgery, radium, x-ray, electrolysis, electrotherapy, actinotherapy, fever therapy and other physical agents are indicated.

Since discontinuing his private hospital at 2215 Walnut and Twenty-third Streets, satisfactory arrangements have been made elsewhere for operative and other cases requiring hospital care.

Pacific Physical Therapy Association

The program of the Pacific Physical Therapy Association of the May meeting offers the following papers:

1. "Dont's in Physical Therapy from the Orthopedic Standpoint." *H. Waldo Spiers, M.D.*, Professor of Orthopedic Surgery, College of Medical Evangelists, Los Angeles.

2. "Minor Orthopedic Treatment," with motion picture demonstration. *G. Mosser Taylor, M.D.*, Assistant Professor of Orthopedic Surgery, College of Medical Evangelists, Los Angeles.

These practical subjects warrant the attendance of everybody.

JOHN SEVERY HIBBEN, M.D., President.

CLEON W. SYMONDS, M.D. Secretary-Treasurer.

Dr. Madge C. L. McGuinness on Annual Program of New York State Women's Medical Society

An interesting feature of the 28th Annual Meeting of the Women's Medical Society of New York, held at the Hotel Martin, Utica, on Monday, May 14, is that Dr. Madge C. L. McGuinness, the silent dynamo of the New York Physical Therapy Society, is listed in several places on the scientific program of that organization. It is not surprising to find Dr. Madge as chairman of the scientific program, because those who know her are acquainted with her tactful and reliable habits of as the saying goes—"delivering the goods." Perhaps she was once an admirer of the late Fra Elbertus, for she has apparently learned the "Message to Garcia" from cover to cover. Indeed, we feel that this recognition is but a stepping stone to greater and bigger ones.

Radium Poisoning Treatment Promising

Future sufferers from radium poisoning may have hope for recovery by a method now being developed by Robley D. Evans, physicist of the University of California and Dr. R. Ware of the Los Angeles General Hospital.

These investigators are now trying out their new method on the few survivors of the unfortunate luminous dial paint workers of ten or more years ago, and so far the results are promising. Radium workers in mines and in laboratories will always be exposed to this dread form of poisoning.

The method follows the work of Dr. J. C. Aub, Prof. F. B. Flinn and Dr. S. M. Seidlin and depends on the fact that calcium and radium are very similar in chemical properties. The calcium absorbed by the body goes mainly into the bony structure and therefore the radium also accumulates there. Since the bones are comparatively permanent in composition the radium remains in place, giving off radiations which wreak destruction on the blood-producing centers and on surrounding bone structure.

Now an excess of parathyroid gland hormone will disturb the normal calcium metabolism, causing the system to lose an excess of calcium. Consequently it ought to eject radium too. Of course after this depletion of the calcium has gone far enough the diet must be made rich in calcium to build the bones up again.

Essentially the process is a rinsing out of the radium-contaminated calcium and a substitution of fresh pure calcium. It is a drastic treatment.

To date it has speeded up the rate of elimination of radium to three times the normal rate.—*Science News Letter*.

Occupational Therapy in the Treatment of Tuberculosis

At the request of the association for occupational therapy and after-care in the treatment of tuberculosis, Drs. Bronkhorst, Hefting and Van Lier presented a communication on this subject. During the acute period, rest is absolutely required, either combined with special treatment or otherwise. Once a patient has improved to an extent that one can expect no further improvement from the treatment, occupational therapy should be begun to restore the patient's strength and readapt him progressively to a normal life. The patient receives no compensation for this work, as it serves exclusively for his rehabilitation and is of a different character from work that is paid for. In many patients a satisfactory rehabilitation cannot be brought about because there is a discrepancy between the recovery to be accomplished and the condition in which the patient may find himself after treatment. The after-treatment may, however, be remedied somewhat by (1) adaptation of hygienic and social conditions to the state of the rehabilitated patient, (2) augmentation of the theoretical and practical occupational value, and (3) regular medical examination. The tuberculosis treatment is dependent on two conditions:

(1) degree of restoration and (2) nature of the conditions.

Effective treatment presupposes sufficient strength on the part of the patient. In estimating the patient's strength, account must be taken of the duration factors and especially of the time when the work is to be done. Tuberculous patients who do not recover 60 per cent of normal strength cannot usually be said to have recovered and are only temporarily improved.—J. A. M. A., *Foreign Letters*, 101, (Dec. 16) 1933.

Lack of Vitamin G May Cause Eye Cataracts

Cataracts and other disturbances of the eyes can be brought about, in rats and mice at least, by a diet lacking in vitamin G, Drs. William C. Langston and Paul L. Day of the University of Arkansas School of Medicine reported to the Southern Medical Association meeting. Feeding vitamin G to the animals retarded the development of the cataract and even prevented its maturing, but did not cure the condition brought about by lack of the vitamin. The Arkansas investigators did not state whether this vitamin has any relation to cataract in man.—*Science News Letter*.

Same Chemical Structure Affects Body Differently

Widely different effects may be brought about in the body by substances having the same chemical structure, is the suggestion found in research just reported by Drs. J. W. Cook and C. L. Hewett, of the Cancer Hospital Research Institute, and Prof. E. C. Dodds and W. Lawson, of the Courtauld Institute of Biochemistry, to the Royal Society of London.

An effect similar to that caused by a female sex hormone may be produced in animals by substances known to chemists as condensed carbon ring compounds. Some of these are structurally similar to and others differ considerably from the oestrus-producing hormone itself. Two of the compounds, in addition to their ability to awaken sexual desire in animals, are potent cancer-producing substances, and one of them is calciferol, crystalline form of rickets-preventing vitamin D.

These synthetic compounds with the widely different effects on the body changed the male plumage of capons to female plumage when injected into the bird's body, Drs. Cook, Dodds and A. Greenwood reported.—*Science News Letter*.

Discussions of Papers on Transurethral Surgery

(Continued from page 294)

success of any form of surgery, but the postmortem showed an enormous remaining prostate, a huge lobe that gave him no trouble. If transurethral resection produces such results it is deserving of the high acclaim given it.

Dr. Owsley Grant (closing): A good deal of confusion about transurethral surgery has arisen from the fact that so very small amounts of tissue have been taken out and called prostatic resections. Things that were done even with the old cold punch, removing from 1 to 2 grams of tissue, could hardly be called prostatic resections. That type of gland should not be included in comparisons with open operations because you are not considering the same type of work. Anybody who has attempted to take out asclerotic prostate knows that it is about the most difficult thing that one can be confronted with in an open operation.

The point as to how far we are to go with resections in real adenoma, that is, in glands where we are planning to remove anywhere from 100 grams of tissue and up, will have to depend upon those men who have more or less mastered the technique, who have shown that they can remove anywhere up to 60 grams of tissue from practically any case that they deem fit to operate upon, with more or less impunity.

Alcock, in his last report of 200 cases — and I will say that he has almost as bad a type of cases as it is possible to imagine in his Iowa hospital — has had a mortality of 3 cases. That is less than 1 per cent mortality. If he can do that, if Davis can resect the cases that he resects, removing 65 and 70 grams of tissue, if at the Mayo Clinic Bumpus and Thompson can remove the large glands with practical impunity, it seems to me that is one thing that we have to consider in considering open and closed operations. If that can be done by a few men, it can be learned by others.

THE STUDENT'S LIBRARY

INTERNAL DERANGEMENTS OF THE KNEE-JOINT. Their Pathology and Treatment by Modern Methods. By *A. G. Timbrell Fisher, M.C., M.B., Ch.B., F.R.C.S., (Eng.)* Formerly Hunterian Professor, Royal College of Surgery of England, etc., etc. Second Edition with 120 illustrations and 60 plates (2 colored) in text. Cloth. Pp. 205. Price, \$3.50. New York: The Macmillan Company, 1933.

This book is highly recommended not only because it presents an important subject in a most attractive and comprehensive manner, but also because the author has been one of the courageous few to point out the value of manipulative therapy, thereby removing the "myst" as it were from the mysteries of the "bonesetter's" art and placing it in its proper status of rational procedure. We hold with Sir Arthur Keith in the foreword, "that there is only one form of curative magic — the application of measures founded on an accurate knowledge of structure, function, and disease," a conviction also held by Mr. Fisher and intelligently expounded by him throughout the pages of this monograph. In this edition (second) the author has fully revised and expanded and even rewritten certain sections "in order," as he states, "to do justice, if possible, to the new work that has been published in the comparatively short time that has elapsed since the publication of the first edition." The opportunity afforded of bringing the subject down to date is indicated by the inclusion of considerable amount of the author's hitherto unpublished work that deals with the symptomatology and diagnosis of lesions of the semilunar cartilages, and the after-results of operations upon the menisci. The body of the work is divided into two parts, the first dealing with the Pathology and Surgery of the Semilunar Cartilages, the second, with the Pathology and Surgery of Other Varieties of Internal Derangement. The book therefore offers a concise review of the subject, in addition to substantial new material by the author. We cannot refrain from also commenting favorably on the clarity of exposition, the absence of redundancy and the author's sincerity of workmanship. An example is his touching acknowledgment of his debt to Sir Robert Jones, the latter contributing in the form of an appendix to the text, perhaps his last written opinion before his lamented departure. There is also an unusually rich reference list appended and an index. Another example worthy of mention is the liberal recommendation of physical procedures as adjuvant measures to aid the speedier restoration of the patient. Here is a work so clearly above the average that we cannot refrain from enthusiastically endorsing it in its entirety.

POPULAR SCIENCE TALKS. A Series of Popular Lectures on Thirteen Interesting Topics. Edited by *Ivor Griffith, P.D., Ph.M.* Volume No. X. Paper. Pp. 307 with illustrations. Price, \$1.00. Philadelphia: Philadelphia College of Pharmacy and Science, 1932.

It is interesting to recall that in 1921 the Philadelphia College of Pharmacy and Science inaugurated a course of popular lectures, delivered once a week. The success of these lectures was so pronounced and the demands for them were so great that it was decided to put them into permanent form. The present volume is the tenth of this series, and incorporates thirteen popular addresses by authorities in their special fields of study. They are: "Triumphs of Medicine," "The History and Romance of Bread," "Potatoes and Electrons," "The Modern Arsenic Habit," "Yeast — In Welfare and Industry," "Aqua Philadelphia," "Useful Milk Products and Milk Preparations," "Gold — A King and a Servant," "Insect Friends and Foes," "Colloids — A Story About Particles," "Vitamins," "Copper — Man's First Useful Weapon," "Manufactured Ice Cream." From the foregoing list one can readily see that the subjects presented have both a timely and interesting appeal. Moreover, presented as they have been in the popular style it is not surprising that one gleans a tremendous amount of information in as if were the capsule form. It confirms the old adage that truth is stranger than fiction, but here truth is presented with the glamour of romance and adventure. We look forward toward the reading of the next (eleventh) volume with that baited breath belonging to readers of serials the interest of which is continually whetted by the promise of more interesting things to come.

SURGICAL ANATOMY. By *Grant Massie, M.D., M.S., (London), F.R.C.S., (Eng.)*; Assistant Surgeon, Guy's Hospital, etc. Second Edition. Cloth. Pp. 458, with 147 illustrations. Price: \$6.00 net. Philadelphia: Lea & Febiger, 1933.

Just as it is uncertain to foretell when accepted ideas may be swept aside by new revealing contributions, so is it easy to predict when a new work may have more than an ordinary influence upon contemporary opinions. The value of the present work besides that of lucid description and coherent exposition reflects an intangible something — a brilliance of literary workmanship — which is the possession of only talented teachers, and hence is bound to have a salutary influence in the field of surgery. The second edition shows material revision in text and brings down to date the opinions of present day surgical practice. Since intimate knowledge of anatomy is a fundamental requisite for best surgical procedure, it has been the author's

endeavor to present this in its clearest relation to clinical and practical application so far as possible. This has necessitated numerous revisions, alterations and additions to the present text. "Among the new sections," we are informed, "are those dealing with injuries of the carpus, infections of the hand, and the surgical approaches to certain of the long bones. There has also been added the final section on the sympathetic nervous system," together with new illustrations. The work is loosely separated into six divisions, covering in the order enumerated "The Head and Neck," "The Upper Limb," "The Abdomen and Pelvis," "The Lower Limb," "The Thorax," and "The Vertebral Column." It is suitably interspersed with bold face subheadings, colored drawings and diagrammatic sketches as aids for speedier comprehension of the text. The publishers are to be commended for the splendid support, such as the luminous illustrations, clearness of type and general format. The book sets a high standard in its field and is worthy of the author and the best traditions of the publishers. It should be in the hands of all progressive surgeons and students.

RÖNTGENDIAGNOSTIK DER KNOCHEN-VERLETZUNGEN (Roentgen Diagnosis of Injuries of Bones). By *Dr. Fritz Schnek*, Oberarzt (Senior Surgeon) of the Unfallkrankenhaus in Vienna. With an Introductory Note by Dozent *Dr. Lorenz Böhler*. Cloth. Pp. 333. With 389 x-ray photographs. Price, 25 marks. Vienna: Wilhelm Maudrich. (American Agency: Chicago Medical Book Co., Chicago). 1932.

The value of a good x-ray film of the osseous part of the human body and its proper interpretation is so well recognized, and the literature on this theme is so large, that one may well question the need of another book on that subject. Careful perusal of the present volume, however, establishes in the reader's mind not only its *raison d'être*, but one will at once admit that it is a very valuable guide to the recognition of any and all known injuries of the skull, extremities, pelvis, and spine. The large number of x-ray plates may suggest that one has to deal with an atlas, but as a matter of fact Schnek has given us a critical text-book of great theoretical and practical interest not only to the radiologist but to the surgeon as well.

In the general part of the book (92 pages) the author takes us through the pitfalls one is apt to encounter in the x-ray laboratory and describes in detail the technical and scientific methods of taking radiographs, of studying and analyzing films, of controlling the manipulations incident to the treatment of fractures, and of investigating proper and imperfect callus formation, atrophy of bones, arthritis deformans, and disturbances following disease, the aim being to aid the surgeon not only in the diagnosis and proper management but also in the prognosis of individual cases. In the special part all fractures and dislocations are taken up regionally. Schnek has as a basis for his work an enviously rich material, such as is seldom available in general hospitals. Böhler's clinic in Vienna has

become the Mecca for orthopedic and industrial surgeons, and Schnek has proved to be an able associate of the well-known bone surgeon. Indeed, it may be said that those who can read medical German and peruse this book with care will derive information which heretofore was possible of attainment only through a prolonged visit in Vienna.

THE PRACTICAL MEDICINE YEAR BOOKS OF 1933: OBSTETRICS and GYNECOLOGY. OBSTETRICS. Edited by *Joseph B. De Lee*, A.M., M.D., Professor of Obstetrics, University of Chicago Medical School, etc. GYNECOLOGY. Edited by *J. P. Greenhill*, B.S., M.D., F.A.C.S., Associate Professor of Gynecology, Loyola University Medical School. Series 1933. Cloth. Pp. About 650. Price \$2.50. Chicago: The Year Book Publishers, Inc., 1934.

The important literature of obstetrics and gynecology that appeared during the year of 1933 is again reviewed by De Lee and Greenhill. The authors once more resume their interesting custom of inserting personal comments in many of the articles discussed. Each contribution is adequately presented. There is enough material in each abstracted article to give the busy practitioner or specialist a substantial idea of what progress is being made in these fields. Where necessary the authors have employed original illustrations. However this year as in the past the reviewer notes a lack of material from the field of physical therapeutics. The gynecologic section presents only 4 articles on electrotherapy and thirteen on radiology. The lack of space for this phase of therapy is due, in the opinion of the reviewer, not so much to the lack of material in the literature, but to the relative value and importance that the gynecologists give to the subject. Perhaps this may be remedied by a separate electrotherapy and radiotherapy edition by the publishers.

THE PRACTICAL MEDICINE YEAR BOOKS OF 1933: UROLOGY. Edited by *John H. Cunningham*, M.D., Associate in Urologic Surgery, Harvard University Post Graduate School of Medicine. Cloth. Pp. 450 with illustrations. Price \$2.25. Chicago: The Year Book Publishers, 1933.

The size of this book is in itself an indication of the tremendous strides Urology has made within the last decade. It has particular value to the urologic surgeon, for despite a fairly good reading acquaintance with the current urologic literature by the reviewer, there are a large number of excellent articles which have appeared in the journals that usually escape one's attention. The chapter on "Kidney," is most thoroughly covered, and that covering "Plastic Renal Pelvic Operations," is, as the editor states, indicative of progress. The literature on "Transurethral Operations," has been sifted, and the worth-while articles have been reviewed fairly, and accurately. This "Year Book," should be in the hands of every urologist, and others interested in urological surgery, for it covers the entire field without being voluminous.

INTERNATIONAL ABSTRACTS

Notes on Diathermy in Ear, Nose and Throat. F. H. B. Norrie.

J. Laryng. and Otol., 49:73, (Feb.) 1934.

The author describes his experience with diathermy in ear, nose and throat conditions and presents a conservative estimate of the value of this agency in conditions enumerated below. He recommends the fulguration or spray coagulation for nose bleeding and the Oudin current for synechia. Bone and cartilaginous spurs can be dealt with rapidly by surgical diathermy, but care should be taken not to produce too large a slough near the septum or perforation may occur. Included in this report is a description and technic for the management of cellular middle turbinates, inferior turbinates and enlarged posterior ends. The author offers a detailed technic of his method for operative work in the ethmoid region, the type of anesthesia and the removal of polypi. The report also includes observations in connection with affections in the maxillary antrum, frontal sinus, vacuum frontal headaches, affection in the sphenoid region, the limited value of diathermy in removal of tonsils—used by him only when dissection is contraindicated—and the removal of redundant uvulae by the cutting current.

Infrared Rays in Dentistry. R. Bullock Jones. Dental Survey, 10, (Jan.) 1934.

The successful use of infrared therapy depends upon a thorough understanding of the physical properties of the course of radiation in addition to the physiologic reaction of living matter when exposed to it. The action of infrared rays if emitted in sufficient intensity, is thermal, producing a burning sensation that is felt instantly, and an erythema that is immediately visible, but rapidly disappears after exposure. Using infrared rays of proper wave length should give the patient exposed, no other sensation than a gentle warmth. It is important to note the distinction between the long infrared rays which may be transferred to the body by conduction, and those rays suitable for dental therapeutics, namely, the short infrared rays which are electromagnetic and deeply penetrating. The author quotes freely from the writings of Dr. L. Biddle Duffield, after which he says, "In my practice I have found thermal radiation to give relief from post-operative pain, . . . pain associated with periodontitis, . . . after root canal treatments."

To test out the value of various infrared radiation appliances for which bacteriostatic or bactericidal claims were made, the author "used the rays . . . in cases of lower third molar pericoronal abscesses, and in suppurative antrum infections." He concludes by saying, "I have not been able

to observe any benefits [in these cases] from the exposure to infrared rays," though treated "daily from one to three weeks."

Intrathoracic and Intra-Abdominal Quartz Lamp Irradiation. C. Fervers.

Munchener Wchnschr., 80:1585, (Oct. 13) 1933.

Fervers calls attention to the fact that in recent years efforts have been made to apply ultraviolet rays to parts of the body ordinarily not reached by the rays: the larynx, the vagina and even the inside of the bladder. The peritoneum has been irradiated with ultraviolet rays in the course of operations. The author devised a new method comparable to this irradiation during a surgical intervention. By puncture, the abdominal and pleural cavities can be subjected to the therapeutic action of ultraviolet rays. The instrumentarium consists of a rod-shaped cold quartz lamp. The shaft of the lamp is silver plated and only 5 cm. at the end is left uncovered, so that the rays are emitted only here. The rays are produced by a glowing discharge in the burner, and a transformer keeps the burner cold in the open as well as in the body cavities, so that the temperature of the body is not surpassed. For special purposes the linear burner may be surrounded by a tightly fitting cover of blue or dark ultraviolet glass. The lamp can be connected with any lighting circuit. The intrathoracic and intra-abdominal treatments require pneumothorax and pneumoperitoneum respectively. The irradiation generally lasts three minutes, after which the small opening is closed with a cutaneous suture or with a clamp.—J. A. M. A., 101:2008, (Dec. 16) 1933.

Effect of Light Treatment on Laryngeal Tuberculosis. Ove Strandberg and Johs. Gravesen. Lancet, 226:128, (Jan. 20) 1934.

No selection of cases is made. In all cases complicated by a laryngeal lesion, light treatment is instituted, unless any active treatment of the lungs requires a postponement for some weeks. Fever is not considered a contraindication. The light treatment is carried out in a well-ventilated hall. The patients are exposed—in the recumbent position—to a series of three carbon arc lamps, each of 25 amperes. The lamps are used according to the rules laid down at the Finsen Institute. The first exposure is for five or ten minutes, according to the general condition of the patient, and five or ten minutes are added each time until full time is reached; namely, one and a half hours four times or two hours three times a week. After 35–50 light baths there is, as a rule, an interval of one or two months, after which the treatment may be

repeated. If any local lesion remains, additional endolaryngeal treatment is given. But such an intervention is not undertaken until the patient is in a favorable condition of immunity.

Several proposals have been made with a view to projecting artificial light directly into the larynx from elaborately constructed lamps. All such methods should, in our opinion, be abolished, as they are quite out of harmony with the observations on the effect of general light treatment.

Method of Electrocoagulation. Luther C. Peter.

Arch. Ophthalmol., 11:22, (Feb.) 1934.

No phase of ophthalmology has awakened greater interest during the last few years than the treatment of retinal detachment. Electrocoagulation by the methods of Weve, Larsson and Safar, or with Walker's electrical unit and his iridium-platinum needles, on the other hand, has been so recently introduced that more time must elapse before one can estimate with accuracy the final results. After practicing the Gonin method, the Lindner-Guist method and that outlined by Safar, the author's experience with the Walker technic thus far seems to warrant the belief that it will eventually prevail by reason of its simplicity and accuracy. Modifications may be made as one's experience grows, but the plan of procedure as now practiced yields excellent results.

Those who have used the Safar needles can readily appreciate the delicacy and finish of the Walker needles, even before actual trial, in their own hands. The insulation on the Safar needle necessarily increases its bulk and size. The un-insulated Walker needle is delicate and admits of a 2 mm. separation which one observes in the fundus, and which is the proper separation required to bring about closure of a tear. The introduction of the needles is easier than by the Safar method, withdrawal is facilitated by the attached silk thread, and the danger of losing the needle or part of the insulation used in the Safar needle is negligible. Cleansing of the needles after operation in the flame of a Bunsen burner leaves them bright and sharp.

Ultraviolet Energy, Its Effect and Intensity at Various Locations and Altitudes. Meldrum K. Wylder; Robert S. Rockwood, and Samuel Budd Lippincott.

Ann. Int. Med., 7:605, (Nov.) 1933.

The work reported was done at the University of New Mexico in collaboration with the University of Michigan. In this work a study of the depletion of the solar radiation of a wave length of 3240 angstrom units was made. The selection of this wave length, 3240, was accomplished by means of a system of filters consisting of a Correx A glass filter and two silver films. The Correx A filter has a transmission band with a sharp maximum at 3200. These transmissions taken in connection with solar energy give a

maximum transmission of energy at 3240. The energy was focused by means of a quartz lens on a four junction bismuth antimony surface thermopile, and the electrical current produced was measured by means of a Leeds and Northrup high sensitivity galvanometer.

Eye Pad for Making Hot Applications. John N. Evans.

Arch. Ophthalmol., 11:268, (Feb.) 1934.

Dissatisfaction with the present methods of heat applications in the treatment of diseases of the eye was responsible for investigations which have led to the development of the eye pad described by Evans. The shape of the pad was so approximated as to prevent undue pressure on the eye. To this end a number of bakelite and hard rubber patterns were formed until one was obtained which met the requirements as nearly as possible, the rounded corners and triangular general shape allowing the application to either eye and yet permitted close contact with the orbital rim. With this pattern as a starting point, a rubber bag was designed to contain the heating element, the surface of application of this bag or pad being formed of a metal plate shaped to correspond to the accepted bakelite pattern. The heating element contained in each pad was supplied by the owner of the license rights. This "thermic mixture" is permanently sealed in the rubber pad. It does not deteriorate and is said actually to increase the life of the rubber.

The finished pad is placed in boiling water, and the water is kept boiling for a specified length of time (perhaps ten minutes). During this period the crystalline state of the contained chemicals is transformed into a liquid state (melted slightly below 212°F.). With the physical transformation of this liquid back into its crystalline form, there is a liberation of energy as heat which gives to the mass its desired temperature. The anhydrous sodium sulphate is varied as necessary to control the rapidity with which the water of crystallization is taken up. As the temperature drops with slowing of the rate of re-crystallization, agitation will stimulate the process so that a few degrees of rise of temperature will occur above the previous level.

Infrared Photography of the Superficial Venous System. Reginald T. Payne.

Lancet, 226:235, (Feb. 3) 1934.

The observations recorded in the present paper have been made during the past six months in the investigation of the superficial venous system. The method has been used experimentally to determine whether or not it was of any value in this direction. The photographs were taken using two 500-watt electric lamps as the source of illumination, and the infrared ones using Ilford infrared plates and filter. Using infrared plates it is possible to get photographic demonstrations of superficial veins which are not recognizable either clinically or by means of ordinary plates. As yet it is very difficult to predict

how any given case will react to infrared photography, but the following tentative suggestions are made: (1), the method is more successful in general in women than in men, probably owing to their thinner skins; (2), normal subcutaneous veins do not show up at all sharply, but the method will demonstrate dilatation or tortuosity of dermal or subcutaneous vessels; (3), very large tortuous varicose veins are not shown to the extent one would imagine, possibly owing to associated changes in the vein wall; (4), the method may have applications in connection with the prognosis after injection of varicose veins, and in the investigation of collateral venous circulation; (5), it may be used analytically in various ulcer cases; and (6) it may be capable of extension in conjunction with the use of intravenous dyes.

The Examination of Diathermy Machines for Local Diathermy Treatments. And Requirements for Acceptance of These Machines by the Council on Physical Therapy of The American Medical Association. Allan Hemingway. J. A. M. A., 101:776, (Sept. 2) 1933.

A clear distinction is necessary between the different uses of diathermy machines. There are machines for surgical use with appliances for electrodesiccation and for "general" and "local" diathermy. Under "local" diathermy will be included treatments of the trunk and extremities in which only a local section is heated, such as the shoulder, knee or ankle. "General" diathermy will be reserved for machines with a larger power output, when the temperature of the whole or a large part of the body is to be heated rapidly. But machines for local diathermy may be used to produce rise in general body temperature if sufficient precautions are taken to prevent loss of heat from the patient.

In a diathermy treatment it will be tacitly assumed that the sole therapeutic benefit results from the production of an increased temperature of the tissues treated. It will be required that in any diathermy treatment there will be no electrical stimulation of any neuromuscular mechanism whereby a sensation of pain or shock results. This requires that the frequency of the diathermy current be sufficiently high to prevent electrical stimulation and that associated with the high frequency current there will be no low frequency surges of current, due to defects of the machine, which will excite the neuromuscular system. It will be required also that the machine be so constructed that there will be a regulator, which will adjust the voltage across the primary of the low frequency transformer in steps such that a wide spark gap interval is unnecessary. The machine must be so assembled as to insure (a) convenience of operation, inspection and repair, (b) ability to withstand moderately rough usage, as movement around a hospital, and (c) complete safety of patient and operator from burns and shock, considering, of course, in the latter case, faulty technic of treatment.

Physiological Effects of High Frequency Current. V. The Non-Protein Nitrogen Partition and the Secretion of Urine in Anesthetized Dogs. John W. Karr, and E. S. Nasset.

Am. J. Physiol., 107:170, (Jan. 1) 1934.

Having observed that the concentration of non-protein nitrogen (n. p. n.) of dog blood is greatly increased during hyperthermia induced by high frequency current (Nasset, Bishop and Warren, 1931) it was decided to investigate this problem further with a view to ascertaining whether the chief fractions of the n. p. n. were concentrated in a parallel fashion. Blood urea was determined in five experiments before and after exposure. In one of these the ratio of urea nitrogen to n. p. n. did not change, in two it was increased, and in the remaining two it was decreased. The rise in n. p. n. was attributed to increased metabolism, concentration of the blood and oliguria.

The authors therefore conclude that in hyperthermia induced by high frequency current the urea, amino acid, creatinine, and uric acid nitrogen fractions of the blood n. p. n. maintain essentially the same relative concentrations up to a rectal temperature of 42 to 44 degrees C. There is some evidence that at these high temperatures protein metabolism, as judged from urea production, may be doubled. There is no evidence of a disturbance to the endogenous protein metabolism. Oliguria and anuria are almost invariable sequelae to hyperthermia carried to 42 degrees C. or higher. It is suggested that dehydration and damage to the renal parenchyma are important factors in the loss of kidney function.

Studies of the Effect of Ultraviolet Rays on Nicotine. V. A. Gant.

Jr. Pharmacol. and Exper. Therap., 49:408, (Dec.) 1933.

Nicotine and its salts when exposed to ultraviolet light or sunlight in the presence of air, decreases in nicotine content and darkens in color. The change under the ultraviolet lamp is much more rapid than in sunlight, due to the higher concentration of ultraviolet rays, but the course of the decomposition is the same. Decomposition of nicotine by ultraviolet radiation is an oxidation process. The oxidizing agent is evidently nascent or active oxygen produced by the action of the rays on air in immediate contact with the surface of the molecules of nicotine.

Neurological Effects of Lightning and of Electricity. Macdonald Critchley.

Lancet, 226:68, (Jan. 13) 1934.

The main types of injury due to electricity and lightning are three-fold — viz., (1) immediate, including shock, unconsciousness, and suspended animation; (2) secondary, including burns, gangrene, visual disturbances, and temporary nervous disorder; and (3) remote effects, which include certain rare neurological and ocular com-

plications. Only those manifestations referable to the nervous system is here considered. The rare cases of nerve disease developing late after lightning or electrical injuries are varied. Such after effects as I have encountered may be classified as follows: (1) cerebral; (2) spinal; (3) mixed cerebro-spinal affections; (4) peripheral nerve lesions, isolated or multiple; and (5) psychological disorders.

Electrosurgical Treatment of Anal Conditions. W. A. Mein.

Brit. M. J., 2:332, (Aug. 19) 1933.

For anal fissures Mein uses the monopolar or Oudin current. After anesthesia, a rectal speculum is introduced and the fissure located and "sprayed" with this current. The dehydrated eschar is left in place. From three to four days after the operation, the anus is gently swabbed out with a mild antiseptic. The patient is allowed up the second day after the operation. In anal polyps, perianal anesthesia is administered and the polyp is brought down. If the base is higher than the line of perianal anesthesia it is injected with a local anesthetic. A pair of curved artery forceps are applied to the base of the pedicle. The polyp distal to the forceps is severed with the cutting current. The electrode is then applied to the point of the forceps and the coagulating current turned on until a zone appears proximal to the forceps. If the base is broad, a catgut ligature should be applied. If the polyp is above the line of peritoneal reflection, the ultimate slough will extend beyond the coagulated area visible at the time of operation. If too heavy or too prolonged a current is used, a perforation into the peritoneal cavity may result. The patient can be discharged in a week or ten days. In anal fistulas, local anesthesia is administered as usual. A soft phosphor bronze wire about three inches in length is used as the positive electrode. The wire is introduced down the sinus in its entire length until a finger in the rectum feels the end of the wire just under the rectal mucous membrane. The wire is withdrawn about one-fourth inch and a medium coagulation current is passed until the skin shows signs of coagulation. With the current still on, the wire is withdrawn and a dry dressing is applied. The patient is allowed up on the following day. In hemorrhoids, after anesthesia, some gauze is rolled into a pear-shaped mass and inserted up the anus beyond the hemorrhoid-bearing area. Traction is made on it. A needle bent to form a small arc of a large circle is used as the electrode. Each hemorrhoid is punctured at the distal end, and the electrode is inserted for a distance of about one-half inch. The coagulation current is turned on until an area of coagulation appears at the entrance. About the same time the hemorrhoid proceeds to "boil." The electrode is removed with the current still on. In cases of thrombosed hemorrhoids, the ordinary straight needle is used. The hemorrhoid is opened with a cutting current and the clot is evacuated by

sponging. A ball electrode is then used, and the interior of the hemorrhoid is thoroughly sprayed with the coagulating current. Any anal tags are excised with the cutting current. The wound is dressed with a pyramidal dressing. The patients are permitted to get up on the fifth day and discharged on the seventh day. Postoperatively, the bowels are not allowed to act up to seven days. This may vary, the criterion being the tolerance of the patient. On the sixth night cascara is given and, half an hour before the bowels act on the following day, from four to six ounces of warm olive oil is slowly injected into the rectum and retained. — J. A. M. A., 101:2002, (Dec. 16) 1933.

Successful Treatment of Vitiligo. M. H. Cohen.

Arch. Dermat. and Syph., 28:215, (Aug.) 1933.

In a case of leukoderma, Cohen instructed the patient to apply a 10 per cent alcoholic solution of oil of bergamot to all the affected areas twice a day. Ultraviolet irradiation with the carbon arc lamp was applied to the face for from three to five minutes twice a week, and an intravenous injection of gold sodium thiosulphate (0.1 Gm.) was given once a week. Within two weeks the areas on the face had begun to coalesce. At each visit the hyperpigmented patches were seen encroaching on the depigmented spots, and in six weeks the face was completely free from any evidence of the disease. The patches on the thighs and abdomen were also lessened, but the improvement was not as rapid as it was on the face, which had received ultraviolet irradiation in addition to the oil of bergamot. The patient was treated for fourteen weeks, during which period she received a total of 1.4 Gm. of sodium thiosulphate. The other vitiliginous areas were treated by several ultraviolet irradiations, with excellent results, but the patient discontinued treatment after her face was freed from the disfigurement. She was seen one year after the last treatment; the vitiliginous areas had not returned. Her face was completely free from any pigmentary disfigurement and the patches on the thighs and abdomen were greatly improved. — J. A. M. A., 101:1756, (Nov.) 1933.

Treatment of Dementia Paralytica by Diathermy. N. B. Graham.

Ment. Sc., 79:89, (Jan.) 1933.

Graham treated twenty-four dementia paralytica patients by diathermy and obtained a clinical remission in 52 per cent. Present results are superior to those following treatment by malaria. The mechanical control of the hyperpyrexia makes this method of treatment safe. Risk of burns is negligible if ordinary care is observed. Respiratory complications have been a feature and caused one fatality. Owing to the small number of cases treated and the short time that has elapsed since the remissions developed, a definite opinion cannot be given about the value of this method.

GRENZ RAY THERAPY IN DERMATOLOGY *

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AND

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Since Bucky's⁽¹⁾ original report in 1925, relative to his investigations of the so-called "Grenz or Infraroentgen Rays," a growing interest in the therapeutic possibilities of these rays has been manifest by the increasing literature. This interest has been particularly noticeable in the field of dermatology because of the therapeutic possibilities of these rays in the treatment of superficial skin conditions, with the result that the majority of the reports dealing with observations and investigations of the clinical application of these rays, have emanated from dermatologists.

A survey of the literature reveals the fact, that the majority of workers in Europe are most enthusiastically inclined to this form of therapy, and some, as Spiethoff⁽²⁾ for example, even to the extent of replacing the roentgen rays with this type of ray for all forms of so-called "local superficial therapy." In this country, however, the reports of the various workers are impressive by their conservatism.

These rays are roentgen rays of extremely long wave lengths and large absorption coefficients. Their wave lengths average two Angstrom units. These, in comparison with the wave lengths and absorption coefficients of the rays generally employed in superficial roentgen ray therapy, have such a low degree of penetrative power, that there is transmitted a comparatively small percentage of the incident radiation intensity through an average thickness of human or animal skin. The effect of these rays is practically limited to the epidermis, with very little, if any, upon the cutis, as shown by Herxheimer and Uhlmann⁽³⁾, who performed histologic examinations in a series of cases.

There is, therefore, a greater degree of safety in the use of these rays than in the x-rays of shorter wave length, which renders them especially suitable for therapy when it

is necessary to avoid temporary or permanent injury to important organs and to glandular apparatus in or under the cutis as, hair roots, sebaceous and sweat glands, testes, and eyes. Even here there are limitations, for with heavy dosage or too frequently repeated applications enough of the shorter wave lengths contained in the heterogenous beam, may be absorbed by tissue below the epidermis to produce undesirable and perhaps serious injury. But even these undesirable results can be avoided if the dosage is properly administered, for if the rays are made harder, they are no longer Grenz but roentgen rays.

The exact status of these rays is not yet definitely settled, many of the investigators, prominent among whom is Eller⁽⁴⁾, who was one of the first in this country to study these rays, being of the opinion that these rays are x-rays of extremely long wave lengths. However, Highman⁽⁵⁾ says that Bucky has never absolutely denied that Grenz rays are a type of roentgen ray, but that Bucky⁽⁶⁾ also calls them infraroentgen rays, and that he contends that in proper dosage and by virtue of their definite physical characteristics, they exert effects on tissue that the more penetrating roentgen rays do not exhibit. Bucky implies that the name Grenz refers only to the biologic actions of the ray which merge into that of the roentgen and the ultraviolet rays, whereas the term infraroentgen might apply to the physical properties of the ray.

According to Eller⁽⁴⁾, the biologic effect of these rays differs from those of the short wave roentgen rays, in that they (a) produce erythema more rapidly, (b) give greater pigmentation, (c) do not epilate, (d) do not penetrate so deeply, and (e) cause an early drop in the leucocyte count which rapidly returns to normal. They resemble the short wave roentgen ray in that they produce (a) latent erythema, (b) pain after marked erythema and (c) cumulative effects.

Relative to the question of the estimation of dosage, by either the direct method ex-

* From the Departments of Dermatology and Physiotherapy, Northwestern University Medical School.

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 15, 1933.

CHART I

Fuhs and Conrad: Results in 2,013 Cases Comprising 64 Different Dermatoses Treated with Grenz Rays

Very Good Results	Good Results	Poor Results
Angioma Cavernosum (1000-1200 R)	Acne Varioliformis (250 R)	Acne Vulgaris
Basal Cell Carcinoma (1000-1500 R)	Perleche (500 R)	Acne Decalvans
Clavus Plantaris (1000 R)	Bromoderma Tuberosum (800-1000 R)	Alopecia Areata
Erythema Induratum (600-1000 R)	Blepharitis (200-300 R)	Alopecia Seborrhoeica
Lymphogranuloma Inguinale (1500-2000 R)	Dermatitis and Eczema (100-500 R)	Congelatio
Darier's Disease (1200 R)	Furunculosis (300-500 R)	Condylomata Acuminata
Pityriasis Lichenoides Chronica (300-400 R)	Hidrosadenitis Axillaris (600 R)	Kraurosis Vulvae
Poikiloderma Vascularis, Jacobi (1200 R)	Lichen Ruber Planus (500 R)	Dermatitis Papillaris Capillitii
Tuberculosis Verrucosa Cutis (1500 R)	Lupus Vulgaris (1000-1500 R)	Folliculitis Decalvans
Verruca Planae Juvenilis (100-400 R)	Mycosis Fungoides (300-500 R)	Granuloma Annulare
	Naevus Flammeus (900-1200 R)	Herpes Simplex Recidivans
	Nail-dystrophie (500-1000 R)	Ichthyosis
	Paronychia (200-400 R)	Keratoma Palmaris et Plantaris
	Psoriasis Vulgaris (100-600 R)	Keloid
	Multiple Idiopathic Sarcomatosis (2000 R)	Leukemia Cutis
	Scrofulodermia (800-1000 R)	Lupus Erythematosus
	Spiegler Tumors (600-1200 R)	Lupus Follicularis Disseminata
	Sycosis Simplex (200-300 R)	Lymphogranulomatosis
	Trichophytia Profunda	Neurinome
	Tuberculosis Ulcerosa (600 R)	Naevus Angiokeratosus
	Verrucae Vulgaris (500-800 R)	Naevus Pigmentosus
		Papulo Necrotic Tuberculide
		Dermatitis Herpetiformis
		Squamous Cell Carcinoma
		Pruritus
		Purpura Telangectoides Majocchi
		Rosacea
		Sarcomatosis Cutis
		Scleroderma
		Ulcus Cruris
		Urticaria Chronicus Perstans
		Urticaria Pigmentosa
		Xanthoma Tuberosum

pressed in R units, or the indirect method expressed in units of erythema, we employed dosage determined by both methods in the course of our investigation and are inclined to agree with the views of Scholtz⁽⁷⁾, who feels that the clinical value of a mechanically standardized and physically precise dosage is much overrated. While it is possible that long experience with the indirect method of measuring dosage, as worked out by McKee and based on the principle of clinical measurement of biochemical effects, employed with the roentgen rays had influenced our views, we feel that a universally satisfactory method will eventually be developed.

The recent literature records many articles on the clinical application of Grenz rays in

dermatology. The most comprehensive is that of Fuhs and Conrad⁽⁸⁾, who record their results in the treatment of 2,182 cases, comprising 64 different dermatoses (Chart I). This is the largest series reported by any individual group. With but few exceptions their results are very similar to those reported by other investigators from all parts of the world. They conclude that "as compared with the usual physicochemical methods employed in dermatology, the Grenz rays are worthy of recommendation as part of the dermatological armamentarium, since in most cases their effects equal those of the x-rays and in some instances are even superior." They report 27 cases in which late sequelae, such as telangectasia, atrophy and pigmentation developed, all



FIG. 1

Photograph showing Erythema and Pigmentation 5 weeks after administration of 250 R units to left arm and 500 R units to right arm. The factors used were 6 cm. distance, 8 KV. and 8 MA.

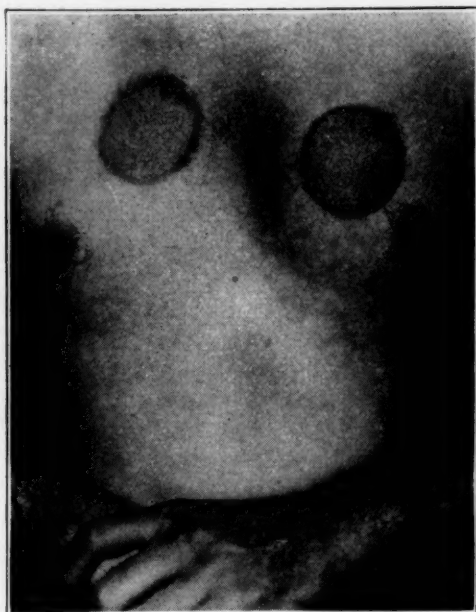


FIG. 2

Photograph showing Erythema and Pigmentation 3 weeks after administration of 750 R units (left) and 1000 R units (right). The factors used were 6 cm. distance, 8 KV. and 8 MA.

of which were mild in character and the majority of which were the result of either repeated high dosage at short intervals or of a combination of Grenz ray therapy with radium, roentgen ray or intensive ultraviolet irradiation. During the past six years of their investigation they have not seen any serious sequelae. They advise on the basis of their experience that the single maximum dose should not exceed 2,000 R units, nor the interval between treatments be less than two to six weeks. In 169 of the total cases reported, the treatments were generalized, while in the remainder they were local.

In our investigation, one of us (D) employed a special transformer which supplied a maximum of 12 K. V. and 12 ma. and which was used to activate a specially constructed modified Coolidge tube made in Berlin, with the Lindemann glass window situated on its under surface. It is a small, water cooled, unipolar, hot cathode glass tube which, with the exception of the Lindemann glass window, is encased in a metal housing.

With this particular apparatus we were able to produce a mild red blush on the flexor surface of the forearm in a young brunette adult within twenty-four hours, employing the following factors: 8 Kv., 6 ma., 3 inch skin tube distance and one minute exposure. This

we considered our erythema dose with this particular apparatus, although as a result of frequent determinations and continued use of the tube, the time factor was increased on several occasions, while the other factors remained unchanged. Of the cases in this series, 154 were treated with this apparatus and fractional doses of one-fourth to one-half unit at weekly intervals were used exclusively.

The other 146 cases in this series were treated by one of us (Z) with an American manufactured instrument, using a tube with a radiation window built in and so constructed that water cooling of the anode was not necessary.

With this particular apparatus we were able to produce an erythema as described above, employing the following factors, 8 Kv., 8 ma., 6 cm. skin tube distance and one minute exposure. This erythema dose was equivalent to 250 R units. The dosage used in the treatment of this series were those recommended by Fuhs and Conrad, and the usual interval between treatments was two weeks.

It will be noticed that in the first group of cases the treatments were given in dosages measured by the erythema unit, while in the second group the treatments were given in dosages measured by the R unit. The reason



FIG. 3

Disseminate Neurodermatitis before Grenz ray treatment.
Photograph taken April 15, 1932.

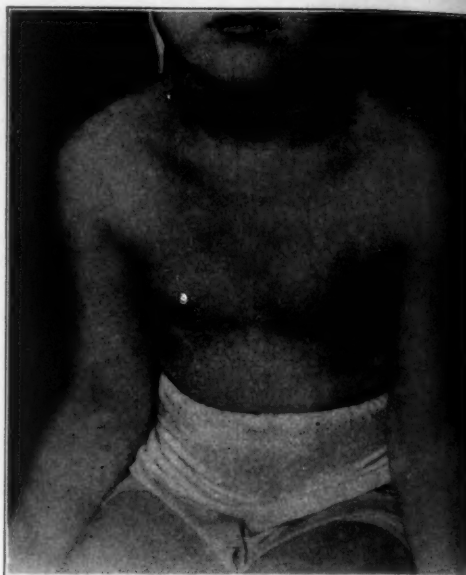


FIG. 4

Disseminate Neurodermatitis after Grenz ray treatment.
July 15, 1932. Two exposures of 250 R units were given.

for this is that the original investigation by one of us in collaboration with White⁽⁹⁾, relative to the treatment of the superficial fungus infections with these rays, was begun before the dosimeters for calibrating these rays in R units had been perfected. The method in use having proven itself quite satisfactory, we felt that a change at that time might possibly result in errors which would gravely influence our investigation.

In this series of 300 cases comprising 22 of the more common dermatoses, approximately one-half of which number was treated with fractional doses, while the other half was treated with full erythema doses, the clinical results were very much alike (Tables II and III) and in general were comparable with and, in most instances similar to the results obtained by workers employing much larger doses.

TABLE 1
Cases in Our Series Treated by Full Erythema Doses

	No. of Cases	Cured	Improved	No. Results
Acne Vulgaris	1	----	----	1
Acne Rosacea	1	----	----	1
Angioma { Portwine Stain	2	----	2	----
{ Hypertrophic	2	----	2	----
{ Irritant	3	----	2	1
Dermatitis { Arsenical	2	1	1	----
{ Eyelids	15	10	5	----
Dermatitis Seborrhoeica	7	1	4	2
Dermatomycosis	23	12	8	3
Eczema	35	10	16	9
Epithelioma (basal cell)	1	----	1	----
Folliculitis	1	1	----	----
Lichen Planus	2	----	----	2
Neurodermatitis { Localized	28	13	13	2
{ Disseminated	11	4	6	1
Parapsoriasis	1	----	----	1
Pruritus Ani et Scroti	2	----	1	1
Psoriasis	6	----	2	4
Verruca Vulgaris	1	----	----	1
Verruca Planae Juvenilis	1	----	----	1
Keloid	1	----	----	1



FIG. 5

Fissured Lichenified Eczema before Grenz ray treatment.
Photograph taken May 1, 1932.



FIG. 6

Fissured Lichenified Eczema after Grenz ray treatment.
Photograph taken July 15, 1932.

Up to the present time we have not encountered any undesirable reactions or sequelae of any type in our entire series. It is our opinion that, if the dosage be confined within the limits of that originally designated for the Grenz ray, namely, not to exceed 10 Kv. and 10 ma., and if the dosage is not too prolonged nor the intervals between treatments too short, and, in addition, the cases for treatment are selected more carefully upon the basis of previous treatment with radium, roentgen rays and ultraviolet rays, undesirable reactions and late skin injuries will rarely occur. We feel that the dosages recommended by various workers, figuring in the thousands of R units are both undesirable and unneces-

sary, for with such dosage they are approximating the roentgen rays and, what is of even greater importance, is the inherent danger of such tremendous dosage. The results we have obtained with comparatively small doses attest this fact.

Impressions

From our experience extending over a period of four years during which we have been able to carefully observe the results in 300 of the cases treated, it is our impression that the Grenz rays will eventually find a limited field of usefulness, especially in the dermatologic domain. Their effectiveness in the treatment of superficial basal-cell epithelio-

TABLE 2
Cases in Our Series Treated with Fractional Erythema Doses

	No. of Cases	Cured	Improved	No. Results
Acne Rosacea	1	----	1	----
Dermatitis Herpetiformis	1	----	1	----
Dermatitis, Irritant	7	3	2	2
Dermatitis, Repens	1	----	----	1
Dermatitis Seborrhoeica	9	3	4	2
Dermatomycosis	94	44	38	12
Eczema	5	2	3	----
Epithelioma, basal cell	2	----	2	----
Erosio Interdigitalis Saccharomycetica	4	1	2	1
Lichen Planus	2	----	1	1
Neurodermatitis { Localized	10	2	8	----
{ Disseminated	2	1	1	----
Parapsoriasis	1	----	1	----
Psoriasis	2	----	1	1
Tinea Versicolor	1	----	----	1
Verruca Vulgaris	1	----	----	1
Verruca Planae Juvenilis	2	2	----	----
Vitiligo	1	----	----	1
Pruritus Ani et Scroti	8	1	1	6



FIG. 7

Lichen Simplex Chronicus before Grenz ray treatment.

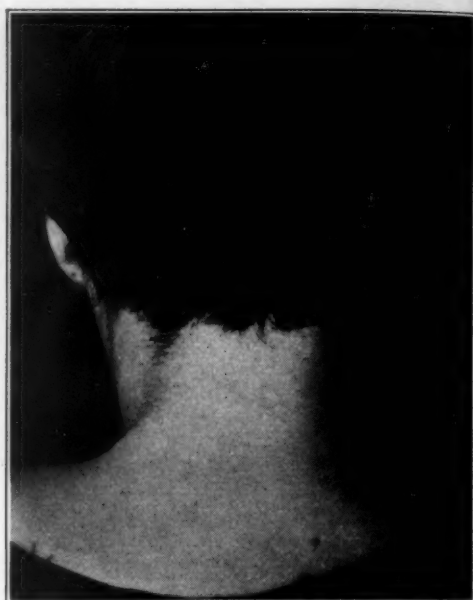


FIG. 8

Lichen Simplex Chronicus after Grenz ray treatment. Three treatments of 250 R units were given.

mas especially of the eyelids and in some senile keratoses cannot be refuted, nor can their preferability to roentgen rays in the treatment of the various dermatoses involving the scalp, and the skin covering radio-sensitive parenchymatous organs, as the eyes, breasts and testes be denied. We have found Grenz rays superior to x-rays in the treatment of localized and disseminated neurodermatitis (lichen simplex chronicus) and in eczema with secondary lichenification. This applies particularly to those cases involving the nape of the neck in women where the eruption extends into the scalp. Unfortunately, some of the brilliant results in this group were not as permanent as we would have liked and recurrences were noted after six months or longer. In eczema of the scrotum we failed to note satisfactory results from the supersoft radiation. In dermatophytosis of the palms and soles and in tinea cruris the response was fully as good, if not superior to x-rays. Portwine stains (naevus flammeus) and angiomas are very definitely blanched by doses of 500-1000 R units applied once a month. In some of the other common dermatoses such as acne rosacea, sycois, seborrhea and psoriasis, we do not feel justified on the basis of our observations in advising the use of Grenz rays.

With greater perfection of the apparatus and precision and standardization of dosage further investigation may reveal sources of

preference for this ray over the x-ray, but we cannot share the opinion that these rays will supplant the x-rays in dermatology.

Two of the most striking disadvantages in the clinical application of this ray in dermatology are, first, the small aperture of the tube, limiting the size of the field of radiation to an area about three inches in diameter, causing the treatment to become very laborious and time consuming, and, second, the persistent pigmentation following single or repeated doses, is a serious drawback in attempting to treat eruptions about the face or neck and is cosmetically disturbing to the patient.

Conclusions

1. Grenz rays have a limited field of usefulness in dermatology, due to their low penetrative power and to the biological action of the rays which is practically confined to the epidermis.

2. The therapeutic application of Grenz rays is further limited by the small size of the field of irradiation, by the cosmetically disturbing erythema which may be required to produce clinical effects, and by the resulting persistent pigmentation.

3. Grenz rays have a distinct advantage over x-rays because larger doses can be applied with a greater degree of safety, epila-



FIG. 9

Angioma before Grenz ray treatment.



FIG. 10

Angioma after 6 months treatment with the Grenz ray, with 1000 R units once a month.

tion is avoided, and serious late sequelae are absent. In treating affections of the scalp, eyelids, and scrotum the danger to underlying structures is eliminated.

4. We have found Grenz rays superior to x-rays in certain superficial mycotic infections, in localized and disseminated neurodermatitis, and in lichenified eczemas. They are also of value in superficial basal cell epitheliomas, es-

pecially of the eyelid, in naevus flammeus, in some keratoses, and occasionally in verrucae planae. In a miscellaneous variety of other inflammatory dermatoses the effect of Grenz rays is probably equal to that of roentgen rays.

5. In many of the commoner dermatoses occurring about the face, such as acne vulgaris, rosacea, seborrhea, and sycosis, the therapeutic effect of the Grenz ray is unsatisfactory

TABLE 3

All Cases in Our Series, Consisting of Those Treated by the Full Erythema Doses and Those Treated by the Fractional Erythema Doses

	No. of Cases	Cured	Improved	No. Results
Acne Vulgaris	1	---	---	1
Acne Rosacea	2	---	1	1
Angioma { Portwine Stain	2	---	2	---
{ Hypertrophic	2	---	2	---
{ Irritant	10	3	4	3
Dermatitis { Arsenical	2	1	1	---
{ Eyelids	15	10	5	---
Dermatitis Herpetiformis	1	---	1	---
Dermatitis Repens	1	---	---	1
Dermatitis Seborrhoeica	16	4	8	4
Dermatomycosis	117	56	46	15
Eczema	40	12	19	9
Epithelioma (Basal Cell)	3	---	3	---
Erosio Interdigitalis Saccharomycetica	4	1	2	1
Folliculitis	1	1	---	---
Keloid	1	---	---	1
Lichen Planus	4	---	1	3
Neurodermatitis { Localized	38	15	21	2
{ Disseminated	13	5	7	1
Parapsoriasis	2	---	1	1
Pruritus Ani et Scroti	10	1	2	7
Psoriasis	8	---	3	5
Tinea Versicolor	1	---	---	1
Verruca Vulgaris	2	---	---	2
Verruca Planae Juvenilis	3	2	---	1
Vitiligo	1	---	---	1

and it is not considered the method of choice.

6. Conservatism in dosage is recommended.

7. On the basis of our observations we do not feel justified in concluding that Grenz rays will supplant x-rays in dermatology.

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Discussion *

Dr. Joseph J. Eller (New York): For the past eight years I have been observing the effects of Grenz rays for certain dermatological conditions. While I feel that these rays are nothing more than roentgen rays of extremely long wave length, and are useful in the treatment of a limited number of dermatoses, it is my opinion that they will not replace the wave length of

roentgen rays which are commonly used by dermatologists in this country and abroad, i. e., a peak voltage approximating 100 kv. The latter are useful alone or in conjunction with other treatments in approximately forty different skin conditions, while the Grenz rays are useful only in the treatment of approximately ten different skin conditions.

As a rule, Grenz rays to be effective must be used in larger doses. I agree with the authors that due to the limited penetration, the Grenz rays have a much greater degree of safety, but it must be remembered that in sufficient doses the latter may also cause roentgen ray sequelae. When Grenz ray sequelae do occur they are of much milder character than those of the usual wave length roentgen rays the dermatologists have been using.

The following skin diseases are the ones in which I have found the Grenz rays to have a distinct usefulness:

1. Multiple flat epitheliomas of the skin. For this condition I found that six to eight times the erythema dose was necessary, usually one dose sufficed, but if another were needed it could be repeated in eight weeks.
2. Verruca planae of the bearded region and other areas of the skin.
3. Localized neurodermatitis.
4. Eczematous conditions of the scalp, eyebrows and eyelids.
5. Certain cases of dermatophytosis.
6. The treatment of port-wine marks and angiomas in my experience were not satisfactory.
7. Acne rosacea and psoriasis were not influenced to warrant their usage in my group of cases.

The limitation of the field of usefulness of these rays does not mean that the dermatologist will not find this apparatus useful in his armamentarium of therapeutic agents, any more than the limitation of radium in dermatology will disqualify its usefulness in a dermatologist's office or clinic.

I feel that certain dermatologists should continue treating various types of dermatoses with Grenz rays or "oversoft x-rays" with a thought of perhaps using these rays with a slightly higher voltage and therefore more penetrating power. This would increase the range of diseases to be treated with a greater degree of safety than that expected from the higher voltages commonly used.

* Author's reprints will contain complete discussion.

THE MANAGEMENT OF NEOPLASTIC LESIONS OF THE ACCESSORY SINUSES AND ORBIT *

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The management of neoplastic lesions of the accessory sinuses and orbit has ever been a troublesome problem for the surgeon and the radiologist. Since, however, electrosurgical methods have come into practical use, the end results in these cases have been materially improved. The purpose of this paper is to call further attention to the increasing possibilities of electrocoagulation, radium and x-rays in the anatomical locations mentioned, and also to exemplify by clinical evidence some of the results that are obtained from their use. The newer developments in the application of electrosurgery and irradiation therapy to neoplastic lesions of the accessory sinuses and of the orbit, will be discussed, and their respective values appraised.

Maxillary Sinus

The Maxillary Sinus is a common site for both benign and malignant growths. For the sake of brevity no effort will be made to classify them according to type, nor to point out the order of frequency in which they occur, since these matters have been well covered in medical literature. Statistics of so-called cures of malignant disease will also be avoided, since they have for the most part proved confusing; indeed, often inaccurate and misleading. Therefore only the clinical phase, which in the last analysis is the most important one, will be presented for consideration at this time, my conclusions having been drawn from a practical experience embracing the study and treatment of over three hundred such cases. Histological slides of all these cases are on file, and the diagnosis well authenticated by accomplished pathologists.

It is absolutely essential that the extent of the disease in the sinuses be first ascertained as accurately as possible by the various excellent methods at our command, chief of which are histological and x-ray studies. Valuable confirmatory evidence can be obtained, however, from the gross appearance, the tactile

sense, as well as by transillumination tests. Without the precise knowledge thus obtained, operations in the sinuses and orbit cannot be intelligently planned.

The soft parts only may be affected, or there may be in addition, involvement of the bones constituting the walls of the sinuses. As malignant disease of the maxillary sinus progresses, it will as a rule show some external manifestation. The hard palate, the alveolus, or both, are very commonly involved by extension of the disease from the antrum; that part of the cheek directly over the antrum may become swollen from the pressure underneath, or from actual malignant infiltration of it. The disease may extend upward and involve the floor of the orbit, causing displacement of the eyeball. The lesion if malignant, when neglected will often become so far advanced that it will eventually involve all of the accessory sinuses as well as the orbit, and perhaps also involve some other adjacent external and internal structures. Obviously, such latter cases are for the most part to be considered inoperable. It may be said, however, that certain of the cases which we have in the past thought inoperable by cold surgery alone, are now quite operable when some form of electrosurgery is employed in combination with it.

If there is no external manifestation of antrum disease other than involvement of the alveolus and hard palate, it is quite possible to perform a complete electrocoagulation operation, thereby removing all malignant tissue and bone, even to resection of the upper jaw. In selected cases the operation can be completed by working entirely through the mouth, without the necessity of making the classical incision through outside parts for resection of the jaw.

The possibility of employing this method of operating was suggested to me by the late Dr. W. W. Keen, who performed a resection of the left upper jaw for sarcoma through the mouth, without scarring the face, upon for-

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mer President Grover Cleveland. An ingeniously constructed cheek and lip retractor was purchased by Dr. Keen in France from Luer, in 1866. He told me that this retractor rendered the operation possible. Dr. Keen was kind enough to loan me this retractor for use in my earlier jaw and sinus work. It was later presented by Dr. Keen to the College of Physicians of Philadelphia, where it is now among the permanent exhibits. This retractor was later reproduced and modified by some American surgical instrument makers, and it is now available to surgeons.

In some instances, when the disease is far advanced, it is necessary to make the classical incision, and dissect back a flap of skin and muscle, since the disease cannot be otherwise exposed for complete electrosurgical work. It has oftentimes been noted that with the employment of electrosurgery, an otherwise hemorrhagic operation is rendered comparatively bloodless, the shock to the patient is infinitely less, and the maximum of normal tissue and bone can better be conserved.

Generally speaking, most of the coagulated soft tissue should be immediately curetted away if friable, or cut away if dense, cartilaginous and resistant, and all necrosed bone likewise should be removed when possible by suitable bone instruments at the time of the operation. Should either primary or secondary hemorrhage occur, it can as a rule be readily controlled by packing.

When the disease manifests itself by external swelling at some point on the face, access to the antrum may be accomplished by making an appropriate incision, through which opening the intervening bone can be removed to expose the antrum, so that the electrocoagulation part of the operation can be properly performed. The involved tissues and bone in the sinus are then removed through the external opening after coagulation of them. The external wound should be permitted to remain open as long as necessary to insure the proper drainage, and also that accurate observations for possible recurrence of disease may be made directly to the site of the former lesion during the process of repair. The wound should be permitted to heal by granulation if electrocoagulation is employed. If the skin and overlying tissues are so diseased that it is impossible to conserve them, then all such tissues should be coagulated, the resulting deformity being of secondary importance.

If the disease has not extended to the cheek, alveolus or hard palate, but only into the orbit, then the antrum may be entered, treated and evacuated through the floor of the orbit, after first enucleating the eye, or if necessary after exenteration of the orbit. The lesion in the sinus is then coagulated and removed, together with the diseased bone, through the opening made in the floor of the orbit, in the manner hitherto suggested. Any deformity resulting from these operations can usually be corrected by a plastic operation, after a reasonable period of time has elapsed without observing recurrence of the disease; or, what is perhaps better, the artificial replacement of lost tissue can be accomplished by the sculpture method.

The importance of removing all necrosed bone when possible is stressed, since failure to remove it might possibly nullify an otherwise excellently performed operation. If this is impossible at the time of operation, then the bone sequestrum which will form after devitalization by the current, can be removed at a later period. Those of us who have had sufficient experience with these cases can testify to the importance of this bone removal. The presence of devitalized bone is one of the chief causes of pain and other discomfort. The heat generated in the tissues by electrocoagulation penetrates into the tissues beyond the zone of actual destruction, and it is of sufficient intensity to produce an inhibitory, if not an actual destructive effect upon cancer cells; it seals blood and lymph channels, which to a certain extent safeguards against recurrence, and also against metastasis, if it has not already occurred.

Radium and X-Rays

Radium and x-rays with modern technic of application, are indeed valuable adjuncts to electrocoagulation, or to any operative method, in malignant disease of the maxillary and other sinuses; but, it is now my conviction that they should not be employed as the major agents when electrocoagulation is available, unless the case is absolutely inoperable, and not amenable to complete operation removal.

Radium should not be employed directly into the sinuses or orbit in close proximity to bone. Experience has shown me that direct radium treatment in sufficient dosage to produce a lethal action upon malignant cells, will

almost certainly produce porosity and necrosis of the bone constituting the walls of the sinuses, even though there was no porosity or necrosis present before the exposure to radium. The necrosis may not become apparent until after lapse of a considerable period of time, even after two years or more. Radium bone necrosis is almost, if not quite as troublesome a matter as malignant necrosis, as many patients who have thus suffered will testify. I have observed this occurrence so frequently in my practice, and in the practice of others, that I feel quite justified in suggesting the wisdom of applying radium from the outside only, thus taking advantage of distance, and the filtration properties of the intervening tissues. By treating throughout side portals of entry the possible complication of radium necrosis will be greatly minimized, without lessening to a great degree the effectiveness of the radium treatment, providing proper consideration is given to dosage.

My impression is, and I believe that most observers agree, that x-ray is in the main less potent than radium in treating malignant disease of the sinuses and orbit. There are some instances, however, when it is impractical to employ radium, in which case x-ray must be used as the only possible, though less effective, alternative. In some instances radium and x-rays may be used to advantage in combination, and by the fractional dose method a greater dose in the aggregate can be given than by the single massive dose method, and with a greater chance of success. The trend is toward this fractional dose method of employing both radium and the x-ray.

The question of the advisability of preoperative radium or x-ray treatment is one for the surgeon or the radiologist to decide, after all factors concerning the individual are considered. It cannot be denied that there is an advantage in inhibiting the activity of malignant cells if possible before any operative procedure is instituted. If according to cell differentiation the lesion is of the proper grade to be materially influenced by irradiation, then preoperative treatment should certainly be given, unless it is shown that in the interval the disease has a tendency to progress rapidly. In such a condition the patient's chances might be jeopardized to a certain extent; then, an immediate operation without delay is but exercising sound judgment. What

is lost can in a measure be made up by post-operative irradiation.

When the hard palate and alveolus, or the upper jaw, is removed by electrocoagulation, a suitable replacement denture can be made, which will at least partially correct the deformity, prevent food from entering the antrum and nares, and will also materially improve the speech.

While recurrences have been noted in all too many instances, one important advantage of electrocoagulation is, that one may operate on a recurrence a second, a third, or indeed, any number of times, with almost the same chance of success as before the first operation. This is because the vitality of the surrounding tissue has been conserved, an important state to successful healing. So much cannot be said of any other operative, or other method of treatment with which I am familiar.

A fair percentage of such cases, even advanced ones, have been observed in which no recurrence has taken place in a long period of time, even up to twenty years, after an electrocoagulation operation, without recourse to other treatment. This was in the days before we knew much about radium or the x-rays. It is advisable, however, now that we have a better knowledge of them, that radium or x-rays be used in conjunction with coagulation through external portals of entry.

The degree of success one may obtain in antrum cases, depends to a great extent upon the degree of advancement of the disease, and I might add, also upon the excellence of the operative technic. Failure to do complete work will only tend to stimulate the disease; hence, unless one is prepared by study and experience to recognize the difference between complete and incomplete work and remove the disease in its entirety if possible, electrocoagulation of malignant maxillary sinuses, or indeed, of any other location, should not be attempted at all. This is such an important point that it will bear reiteration.

Anaesthesia. Ether anaesthesia has been found to be satisfactory and comparatively safe in electrosurgical work if precaution is taken to fan the ether fumes away from the operative field before starting the actual work, and also to be certain that there is no free ether near by while the operation is in progress. Ether is re-administered if necessary during the course of the operation. All

methods of anaesthesia have been tried by me and the advantages and disadvantages carefully considered, but experience has taught me to believe that ether is still the anesthetic of choice if it is carefully administered.

Metastasis. It has been observed that even advanced malignant disease of the maxillary and other sinuses may sometimes be existent without the incidence of metastasis to the cervical or other glands. The lymphatic drainage system from them is such as not to favor early metastasis. In not a few instances, however, metastasis does occur, and then the choice of treatment of the metastatic nodes is decided upon after studying the morphological characteristics of the cells, as well as the study of other individual factors. No dogmatic rules can be formulated with any degree of satisfaction. In some instances it is best to resort to the classic scalpel and hemostats, or to the high frequency knife, for a block resection including the nodes, but radium and x-ray in addition should not be omitted. I think all surgeons and radiologists are in agreement on this point.

It will not be amiss to mention the fact that electrocoagulation cannot often be used to advantage in metastatic lesions; its field of usefulness, with few exceptions, being limited to the removal of primary accessible lesions. In very advanced cases of inoperable metastasis, we must rely upon radium or the x-ray, employed singly or in combination, since there are no other alternatives to consider. As before stated, when metastasis occurs, no hard and fast rule can be laid down, since every case is a law unto itself. Therein lies our weakness; we must feel our way, and that way is filled with responsibility. The problem of metastasis, while troublesome, is fortunately not necessarily a hopeless one in every patient, as all experienced radiologists will testify.

Grading of Tumors. Broder's method of grading tumors, though not infallible, has proved a valuable guide to me in making a prognosis, and also in assisting me to a decision regarding the choice of treatment to be given. This grading is a boon to the radiologist, since one who takes advantage of present knowledge concerning cell differentiation, will be able to regulate dosage with greater accuracy and satisfaction.

Hemorrhage. Serious hemorrhage following electrocoagulation is not greatly to be

feared in neoplasms of the accessory sinuses, owing to the ease with which the sinuses can be packed. In some instances, however, when the disease not only involves the sinuses but other adjacent structures as well, it is possible to control this by means of the larger branches of the external or internal carotid artery. In such case it is but exercising good judgment to ligate the external carotid artery before attempting operation. It may even be necessary to ligate the common carotid artery. This latter ligation should be avoided however, when possible, owing to the hazard of a resulting hemoplegia, especially in elderly people. This possibility cannot however, be seriously considered in a decision, when the indication for it is plainly evident; it is truly the lesser of two evils. In conditions where there is difficulty in ingesting food following an operation, a gastrostomy for ease in feeding may be a life saving expedient.

Relief of Pain. It is noteworthy that a high percentage of patients are relieved of pain following electrocoagulation. It has also been too frequently observed that the pain is often intensified after radium treatment, especially if used interstitially as the primary major agent, before the adventitious element has been removed.

Ethmoid, Frontal and Sphenoid Sinuses

The same general principles apply to the removal of neoplasms of the ethmoid and other sinuses as of the maxillary sinuses. It is next to impossible to remove a growth of the ethmoids by electrocoagulation through the nares in a satisfactory manner; at least, I have been unable to do so. Another method of gaining access to the ethmoids is by the external route, by which it is necessary to first make an incision and through it remove some of the overlying bone. The possibility of impairing the function of the eye by this procedure should be borne in mind.

Primary malignant disease of the ethmoid sinuses usually involves the orbit sooner or later, and may be manifested by displacement of the eye ball, and perhaps in some cases by impairment or loss of vision. In case of such orbital involvement, a primary enucleation of the eye, or even a complete exenteration of the orbit by electrocoagulation is indicated, which can be accomplished without injury to the orbital plates if care is exercised. The ethmoids may then be entered through the

internal orbital plate, and the diseased contents removed after electrocoagulation. If there be involvement of both the ethmoid and maxillary sinuses, a condition often met, the ethmoid can be reached through the mouth after preliminary resection of the jaw.

The frontal sinus may be entered to expose it for an electrocoagulation by removal of the overlying section of the frontal bone, or through the superior orbital plate, slightly back from the rim of the orbit, after enucleation of the eye, or if partial or complete exenteration of the orbit, depending upon the extent of the disease. The diseased tissue and possible necrosed bone may then be electrocoagulated and both removed by the method described under maxillary and ethmoid sinuses.

Radium or x-rays should likewise be employed from outside portals, to exert an inhibitory or lethal influence upon any possible remaining malignant cells that escaped electrocoagulation. What has hitherto been said concerning metastasis secondary to cancer of the antrum, is also true of malignant metastasis of the ethmoids and frontal sinuses, with the important exception that there is more likelihood of metastasis from the primary lesion, or extension of the disease from it, or of intercurrent infection of the closely adjacent meninges, or of the brain.

The removal of neoplasms of the sphenoid sinus by electrocoagulation is not in my experience very practical, owing to its greater inaccessibility, and also to its close proximity to the brain. In such cases I have from necessity depended upon radium and x-ray as the only practical measures offering a promise of palliation or relief. This is a field, however, in which neurosurgeons in particular are making some progress.

Orbit

The orbit is subject to a variety of neoplasms, both of a benign and malignant nature. Neoplasms of the canthi, eyelids, cornea, palpebral and bulbar conjunctivas, will not be considered at this time, but I might mention that experience has shown me that the electrodesiccation method can be employed with a great degree of satisfaction. I prefer it as the major agent to any form of irradiation treatment for this work.

In extensive disease of the orbit, it is advisable to first perform a complete exentera-

tion by the electrocoagulation method, and experience has shown me that it is incomparable for this purpose. If the orbital plate nearest the brain is not involved, the chance of success is greatly enhanced. If this osseous structure is involved, the chance of success is minimized, owing to the possibility of a complicating postoperative meningocele, or of traumatic or infective meningitis. A few cases have come under my observation in which part of the orbital plate nearest the brain had of necessity been partially removed owing to disease of the bone. The dura has been seen to pulsate after removal of the bony plate, but happily nature has often compensated for this removal by the formation of fibrous thickening of the dura, which protected the brain from trauma, infection and meningocele.

Exenteration of the orbit by electrocoagulation has been successfully accomplished by me many times without injury to the orbital plates, but there is certainly no anatomical location in which greater care must be exercised when operating. The operative electrode should not touch, nor be held in close proximity to any bony structure in the orbit, and the heat penetration must be carefully controlled, else damage will be done to the orbital plates, with the occurrence of subsequent non-malignant necrosis of the bone, or, indeed, coagulation of a part of the brain might accidentally occur.

After coagulation the diseased tissue is removed, either by curettage if the tissue is friable, or if resistant, by means of sharp scissors, down to the apex of the orbit, and in addition to this, the periosteum, as well, is sometimes stripped from the orbital plates. It has been observed that the heat from the current aids in the separation of the periosteum from the bone, thus rendering its removal with the finger or a periosteal separator a comparatively simple matter.

When the disease does not extend quite down to, or into the foramen, it is advised that a tuft of normal tissue be permitted to remain in the foramen and apex, thus the possibility of injuring the dura or brain by heat penetration, or of the opening of an avenue into the brain for subsequent infection, may be avoided. The danger of a postoperative meningitis from an infected necrotic slough is thus greatly minimized. Bacterial invasion of the slough may be avoided, or at least the

possibility of it greatly reduced, by the judicious postoperative use of suitable germicides, those with a chlorine content being preferred. It has been observed that after the periosteum has been removed from the bone, healthy granulations will rapidly grow and fill up the orbit.

Exenteration of the orbit may be accomplished by electrocoagulation without the necessity of sacrificing the eyelids, if they are not primarily involved with disease, even though the orbital involvement is extensive. By incising and dividing the upper and lower eyelids vertically through the cartilage, and then by dissecting them from their attachments well back beyond the rim of the orbit, and temporarily anchoring them in place to the adjacent skin by means of sutures, the lids will be protected and one may proceed with the exenteration of the orbit without great subsequent deformity to the eyelids. After the exenteration is completed, the eyelids can be restored almost to normal if the divided sections are carefully sutured together.

Hemorrhage in the orbit during or following the operation can be effectively controlled by packing. Advanced malignant disease of the orbit is frequently observed without the appearance of any metastatic lesions, although this observation is by no means a constant one, nor to be depended upon. Perhaps the most frequent site for metastasis when it does occur, is in the liver. In such a complication, radium in proper dosage, or the x-rays, are the only alternative methods of treatment to consider, but at best the results of treatment of metastasis to the liver, are not very satisfactory.

Summary

Electrocoagulation can now be numbered among the effective methods designed for the

removal of operable primary lesions of the accessory sinuses and orbit.

Success with electrocoagulation is materially increased by the postoperative employment of radium or x-ray, the preference being given to radium, wherever possible.

Preoperative irradiation treatment is good practice in selected cases, though in some instances delay in operation might conceivably jeopardize the chance of success. It should be employed, however, whenever possible, to inhibit the activity of malignant cells, before any kind of operative procedure.

Radium should not be applied routinely directly into the sinuses or orbit, owing to the possibility of causing porosity or necrosis of the bone with which it comes in close proximity. It is preferred that such treatment be given through outside portals.

In inoperable cases, and in the event of extensive metastasis, either radium or x-ray must of necessity be employed, either singly or in combination, as the only known methods of proved value.

The results of irradiation treatment in metastatic lesions are not uniform, and in the main it is palliative in effect rather than curative.

Broder's method of grading tumors according to the degree of existing cell differentiation, is a valuable, though not an infallible guide, in prognosis, and also in the choice of treatment to be administered. It is a fairly trustworthy guide to radium and x-ray dosage.

The foregoing observations and conclusions are based upon the study and treatment of over 300 cases of neoplasms of the accessory sinuses and orbit.

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(For discussions turn to page 350)

MALIGNANT EPITHELIOMA OF THE NECK *

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Within the past half decade modern electro-surgical technic was available for the operative treatment of thirty patients with epidermoid carcinoma of the neck. These cases belonged to a group that had been accurately diagnosed and in which end results are available. Squamous cell carcinoma predominated (73.3 per cent); basal cell carcinoma was next in frequency (23.3 per cent) — and least in number was basal squamous carcinoma (3.4 per cent). The incidence of males was high — (93.3 per cent) due to the large number of cases secondary to oral cancer. The total mortality (40 per cent) was limited to squamous and basal squamous cancer. The mortality in grade four cases was seventy-five per cent; in grade three cases, fifty per cent; in grade two cases twenty-five per cent — and in grade one cases — zero.

Classification

Two main groups were identified — primary and secondary. *Primary* epidermoid cancer of the neck occurs extrinsically in the skin — and intrinsically in the stratified squamous epithelium of the vocal cords. The results in the external group were excellent; in the internal group were bad, except in early diagnosed epithelioma of the vocal cord in which laryngofissure was done. *Secondary neck cancer* occurred as the result of extension of epithelioma arising in *dry epithelium* (skin cancer); and from *moist epithelium*, viz., cancer of the lip, buccal mucosa, and tongue — all types named in inverse order of their degree of malignancy. It was in the cases of neglected, radio-resistant or recurrent secondary cancer of the neck that our poorest results have been obtained. The greatest number of the patients was marasmic and septic, as a result of the buccal malignancy. Oral sepsis, dental neglect and ill fitting dentures were present in eighty-four per cent; abuse of tobacco, pipe smoking and chewing in seventy per cent; and lues in thirty per cent of cases of neck cancer secondary to buccal malignancy. "La mort entre par la bouche." (Death enters by the mouth.)

Evaluation of Prior Treatment

This is always problematical. Previous radiation (x-ray and radium) is adjudicated good when the final results are good. On the other hand we are prone to condemn it as a waste of time in those lesions (more often squamous celled types) in which radio-resistivity occurs.

Our statistics are incomplete and our cases too few in number to justify arbitrary conclusions. However, our worst results, deaths and mutilations, occurred in that group of sadly neglected cases which had not received *any kind of therapy* now recognized as *adequate for cancer* — viz., *surgery, x-ray or radium*. Quasi-medical or dental supervision, curettements, extractions, and escharotics applied for weeks, months, or even years in some cases, before the victim of the chronic ulcer or wart which "would not" heal, was finally seen by some "cancer minded" consultant. Almost equally disastrous was knife surgery, excision or incision, either for attempted extirpation or for biopsy, which on several occasions was observed to have been followed by prompt recurrence with rapid spread, and ultimately a mutilated or fatal result, despite electrosurgery. We have never seen this occur as a result of electrosurgical biopsy via the wire loop cutting current technic. This when properly performed is a simple, safe and satisfactory method for determining the histologic picture, so important in clinching the diagnosis and determining the degree of malignancy. Prior radiation, although inadequate to cure in a certain group of mouth cancers, appears to be well worth while as a routine measure in our effort to prevent cervical extension. In half the cases which were referred to us by radiologists, following conscientious radiation not only of the local lesion but also of the neck, but in which failure had followed — we have succeeded in obtaining an apparent cure. Our results seem to indicate that radium is preferable for local application within the buccal cavity — and that X-radiation is best for the neck. Thermodestructive surgery appears to be the most efficient single agency in operable cancer, and

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varies directly in efficiency with the degree of heat penetration available. Fulguration or superficial sparking is the least efficient, the actual cautery knife much more efficient, and modern high frequency electrosurgery with its combination of cooking and cutting currents the most effective agency for readily accessible cancer.

Evaluation of Our Own Technic in Cervical Cancer

We have profited some by our early mistakes — and our later statistics show improved results. Our statistics show excellent results in the low grade primary localized lesions (90 per cent). In the high grade, extensive, radio-resistant or recurrent group our results have varied chiefly in proportion to the sequence of operations followed. *Preferred Sequence.* Preliminary x-ray to the neck. The common or external carotid is ligated under local anesthesia, and ten days later radical electrocoagulation and block resection. Later we complete the removal of the primary lesion in the mouth — then sequestrectomy and control biopsies are done from time to time — and finally plastic repair. This ideal procedure, formidable and protracted as it appears to be, has given us about fifty per cent apparent cures — but always with some disfiguring scar. On the other hand, in those patients in whom we have been content to remove only the local lesion, and depend upon roentgen ray of the neck for lesions already present, or which developed despite vigorous x-ray — we have been forced to operate the neck under far less favorable conditions — and with a resultant eighty per cent mortality. It is true that we have more than once excised the submaxillary nodes below a buccal epithelioma and found no extension of the malignancy. If as has been claimed, approximately half such cases of apparent extension in early malignancy will be shown at biopsy to be nothing more serious than secondary infection, we are still of the opinion that the procedure is well worth our while. When we consider the comparative lack of hazard in surgery of the submental and submaxillary region, and the likelihood of sealing the lymph spaces against possible later extension into the upper deep cervical nodes, we believe that if the surgeon has apparently erred he has done so on the side of safety. It is better to eradicate possible cancer more thoroughly than necessary than to run the risk of incomplete removal.

Technic of Neck Operations for Malignant Epithelioma

Primary extrinsic epithelioma may often be excised under local anesthesia. Arising in the skin, adjacent and subjacent structures are of no consequence — except possibly the external jugular vein, which when severed high up or low down should be ligated — because of its connection with the deep veins. The small spurting vessels are easily sealed by hemostat coagulation — and the superficial fascia, or platysma may be resected or coagulated as need be to ensure proper "cauterization" of the wound. Sutures are seldom necessary. Excellent wound healing by granulation follows the removal of small localized lesions. These lesions are located as a rule below the ear and behind the sternomastoid. Wounds as large as the palm of the hand, involving the entire posterior triangle have healed with a surprisingly good and flexible scar. Plastic repair may be required for large lesions in the anterior triangle — but small ones heal kindly by granulation — with or without skin graft.

Primary intrinsic epidermoid cancer — located upon the vocal cords may be attacked by laryngofissure, with blunt resection of the cord and overlying malignant papilloma from the thyroid cartilage, and excision from the arytenoids and from its inferior attachments by the cutting current. The final step should be careful but thorough electrodesiccation of the wound — with especial care not to coagulate the thyroid cartilage. The end results in this operation have been good. We have had poor results with laryngectomy — which has been used only in the advanced cases with external metastases.

Secondary Neck Cancer — Extension From Dry Epithelium of Auricle or Face

The ideal technic is excision of the entire mass including the primary lesion and the neck extension. If the extension is superficial to, or behind the insertion of the sternomastoid, little difficulty is experienced, although sharp spurting hemorrhage is to be expected. If the lesion involves the posterior cervical chain of lymph nodes, the spinal accessory at about the middle — and the upper cords of the brachial plexus at a more inferior level — may be endangered. They lie just beneath the deep fascia — and since they are important motor nerves should be respected. If the extension lies anterior to the sternomastoid, and superficial — no especial

difficulty is encountered. If on the other hand it involves the deep cervical nodes — the location is hazardous and operative removal a formidable procedure. Anomalous veins, as well as those usually present — the various branches of the external carotid artery, the facial nerve and the contents of the carotid sheath are all structures that may have to be resected in advanced cases. Prior ligation of the common carotid artery should be done in those cases in which complete eradication of the deep cervical nodes is contemplated. Since the deep cervical nodes are so closely clustered about the internal jugular vein, it together with the carotid are usually resected together with the overlying sternomastoid which is found to be friable and infiltrated with cancer in such cases. The posterior lying vagus should be spared if possible — and its companion nerve trunk the sympathetic ganglionated cord. The same is to be said of the phrenic nerve, which lies in front of the scalenus anterior, and is both lateral and deep to the field of operative removal. This entire operation may be done under avertin anesthesia by electrosurgical technic, excepting of course the ligation of major blood vessels and their immediate branches.

Secondary Neck Cancer — Extension From Moist Epithelium

This type is usually much more virulent than that arising from the external stratified squamous epithelium. We have already given the ideal procedure which should begin with ligation of the carotid artery. If the lesion is high in the neck, the external carotid should be chosen in order to prevent cerebral vascular block. In most of our cases we have been forced to ligate the common carotid; usually this was due to the advanced degree of the extension. In one instance we found anomalous division of the common carotid — almost as high as the angle of the jaw. This patient and two others died from the cerebral ischemia complicated by surgical shock. Operative surgery for cancer of the neck demands a practical working knowledge of the applied surgical anatomy of this region. In addition, the ability to skillfully utilize a modern electrosurgical unit is an asset of no little value. The small measure of success which we have experienced in these cancer derelicts has been chiefly due to these technical factors, and a penchant for eradication as the last and only hope of relief. When we contrast the

results, however, from electrosurgery *alone*, in local cancer of the lip for example, with that of the same disease *after it has extended into the neck*, we realize the crying need for missionary work among the profession. In our clinic we have obtained good results in ninety-five per cent of cases of proven cancer of the lip — operated by electrosurgery in its early, localized stage. On the other hand in this present series of neck cancer — with the primary lesion located in the lip, we present the following data: All had septic mouths; sixty per cent were luetic; sixty-six per cent had recurred after some form of operative incision by dentist or physician; sixty per cent had resisted x-ray or radium; and ninety per cent were high grade malignancy (biopsy). Our mortality in this group was 43 per cent—to date—(third year) and will be higher before the five years have terminated. Corresponding data might be given for neck cancer arising in the buccal mucosa and on the tongue. The comparative mortality figures are fifty per cent for the buccal and seventy-five per cent for the lingual group. Following our electrosurgical procedures, heavy postoperative x-ray was helpful in twelve per cent — and of no apparent value in thirty-six per cent of cases. It seems obvious that in these advanced cases more than one therapeutic procedure should be used, but "each should be administered as vigorously as if we depended entirely upon it alone." (Kelly and Ward.)

There is nothing inspiring, nor optimistic in the contemplation of results in high grade metastatic cancer. On the other hand we can be almost proud of our results in electrosurgery of early localized cancer. There are many men in our profession who are so pessimistic in their attitude toward treatment of this disease that they do not advise *any treatment, of any kind, at any stage* in its development. There are others who operate by scalpel when the lesion appears to be local, but who discourage any effort on the part of the patient to obtain eradication of the disease in its later stages. Finally there are some of us who believe in giving every cancer victim who is not *obviously incurable* or *moribund* a chance for his life — even though mutilation of some degree is unavoidable. In many of these, after months of repeated efforts, an inoperable extension may develop, or the patient is mercifully carried away by some intercurrent affection. In a few oth-

ers, even in the higher grade malignancies, when we have vigorously applied all our known measures, at least alleviation and prolongation of life are obtained.

By accurate gradation of cases, preliminary carotid ligation, careful preparation for surgery and choice of anesthetic, followed by painstaking and radical electrosurgical extirpation, and this by diligent after care, gastrostomy, intravenous infusions and blood transfusions, and finally by plastic repair we may save an increasing number of these radio-resistant recurrent or neglected human wrecks. How much better it would be, however, if we could only persuade the general medical and dental profession to "USE PROPHYLACTIC ELECTROSURGERY FIRST."

Statistical Data — Electrosurgery for Epidermoid Cancer of the Neck

All cases subjected to biopsy, and routine laboratory tests — with gradation of malignancy and follow up reports to July 1, 1933. Total cases — thirty.

	Alive	Dead
Primary epidermoid cancer — neck involve- ment only	11.	9. 2.
Primary extrinsic cancer — skin cancer....	8.	8. 0.
Squamous celled	5.	5. 0.
Basal celled	3.	3. 0.
Primary intrinsic cancer (vocal cords)....	3.	1. 2.
Secondary epidermoid cancer — neck ex- tension	19.	8. 11.
Extension from dry epithelium — skin cancer	4.	2. 2.
Squamous cell cancer face head.....	2.	1. 1.
Squamous cell cancer head.....	1.	1. 0.
Basal squamous cancer head.....	1.	0. 1.
Extension from moist epithelium (squamous cell)	15.	6. 9.
Squamous celled cancer lip — metastatic neck	7.	4. 3.
Squamous celled cancer buccal mucosa — and neck	4.	1. 3.
Squamous celled cancer tongue — metastatic neck	4.	1. 3.
Distribution as to histology and gradation..	30.	17. 13.
Squamous celled cancer.....	26.	14. 12.
Basal squamous cancer.....	1.	0. 1.
Basal celled cancer.....	3.	3. 0.
Grade one cases	6.	6. 0.
Grade two cases	4.	3. 1.
Grade three cases	16.	7. 9.
Grade four cases	4.	1. 3.
Distribution as to sex:		
Males	28.	16. 12.
Females	2.	1. 1.
Distribution as to ages:		
80-89	2.	1. 1.
70-79	4.	1. 3.
60-69	11.	5. 6.
50-59	7.	6. 1.
40-49	3.	2. 1.
30-39	3.	2. 1.
Analysis of end results:		
Total deaths 13. Deaths from cancer 6.		
Died P.O. shock, etc., 5.		
Died natural causes, 2.		
Alive but incurable (?) or otherwise unsatisfactory — 2.		
Total dead and unsatisfactory cases.....	15	or 50%

Effects of prior treatment, prior conditions, and our management on results after electro-surgery of neck cancer.

Prior therapy.	Low grade cases (grades one and two)			High grade cases (grades three and four)		
	Alive	Dead	Unsatisfy	Alive	Dead	Unsatisfy
None or						
Escharotics	7.	1.	1.	1.	6.	6.
Scalpel only	1.	---	---	4.	3.	4.
Cautery fail.	---	---	---	2.	---	2.
"Fulguration" ..	1.	---	---	1.	1.	1.
X-Ray failure ..	1.	---	---	6.	5.	5.
Radium failure ..	---	---	---	1.	1.	1.
Bad dentistry ..	1.	1.	1.	6.	10.	11.
Abuse tobacco ..	4.	1.	1.	7.	8.	9.
Lues	---	---	---	1.	5.	6.
Our management:						
P.O. X-ray ..	---	---	---	2.	2.	3.
Neck op. first	9.	1.	1.	4.	4.	4.
Neck op. last	---	---	---	3.	9.	9.

Conclusions

Although these statistics are too few to give accurate mathematical data — the following general conclusions appear warranted:—

1. Unsatisfactory results after electro-surgery are far less frequently seen in low grade malignancy — irrespective of prior neglect or failure of treatment.

2. High grade cases of malignancy are commonly seen in which the following factors are present — as evaluated from the poor results obtained:—

A. Bad dentistry (includes self-neglected) oral sepsis and constant mouth irritation from any cause.

B. Abuse of tobacco — chewing tobacco, pipe smoking, cigarette and cigar.

C. Syphilis and self-neglect or inadequate escharotic treatment, in about the same degree.

Lack of effective or adequate eradication of any sort.

(a) Prior radiation by x-ray and radium, in radioresistant cases. (No biopsy.)

(b) Prior surgery — incisions, curettement, etc. (Scalpel biopsies.)

(c) Inadequate thermodestructive agencies — fulguration and cautery. Therapeutic factors are given in the reverse order of their efficiency.

3. Our results were bad enough in metastatic cancer of the neck when we operated the neck first, doing carotid ligation, then block resection. (Mortality fifty per cent.) They were much worse however, in those cases in which the primary lesion alone was attacked at the first operation, and in which radiation of the neck was relied upon to control the growth. (Mortality in late neck surgery — eighty per cent.)

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MALIGNANCY ABOUT THE HEAD *

Radiation or Electrosurgery?

T. C. GALLOWAY, M.D.

EVANSTON, ILL.

Time and experience have proven the great value of surgical diathermy in chosen types of malignancy. It is no longer necessary to discuss basic principles, but it is perhaps time to take stock of our methods and refinements, and to consider the selection of cases.

Since a previous presentation before this society six years ago, I have never seen the need of losing any enthusiasm then expressed for electrosurgery. Cancer is a deadly enemy, a tenacious and insidious invader, often giving no warning until late, yet the results of treatment are frequently so satisfactory and occasionally so brilliant that we may get a real thrill of victory in a desperate battle.

Technic of Electrosurgery

As for technic, I still use for malignancy almost altogether biterminal electrocoagulation, on account of its ease, simplicity, better protection at the border, better hemostasis and sufficiently radical destruction. Cutting currents may shorten the time where a cheek for example, or the palate or tongue are involved but by as much as they do this they less certainly destroy cancer cells. Desiccating currents I have found uncertain for all except the most superficial work. Circumvallation technic is employed using a coarse needle as the active electrode with a heavy current in order to save time for the final clean-up of the field.

Coagulated tissue is removed by curette or punch forceps and coagulation carried definitely beyond the growth. The feel of the needle in malignant tissue as well as sight determine the limit of extension. Bone is destroyed if involved or adjacent with the knowledge that it will cleanly sequestrate. Finally the surface is desiccated to prevent oozing and to form a matrix that will not prematurely separate. Following this practice we do prophylactic tracheotomy much less often than formerly because of the lessened danger of aspiration. Ligation of

important vessels especially of the external carotid and lingual arteries is usually advisable both to make the operation bloodless and to prevent secondary hemorrhage that may come from a large trunk when coagulated tissue sloughs. Great patience and thoroughness are required, though unlike scalpel surgery, if we fail to get all of the growth at the first attempt, active proliferation is rare.

Diathermy is not to be done half-heartedly. No one should do electrosurgery for cancer who has not the hardihood to sacrifice all but the most vital structures that may be involved. The eye or the tissues up to the dura itself should not stand in the way of adequate destruction. I have even sacrificed the common carotid artery and the vagus nerve, but I now believe that few growths that involve them can be successfully attacked by electrosurgery.

Radium and X-Ray Therapy

In my opinion the greatest recent advance in cancer treatment has been in the direction of selection of cases. Even the most ardent proponents of surgery and diathermy must recognize that certain cancers will do better with radium or x-ray. I have wasted much almost heroic effort to cure carcinoma of the tonsil by electrosurgery but a single four year case is my success. On the other hand Duffy reports 20.4 per cent cures here, and I know my time and energy will not be wasted in such cases when proper irradiation is obtainable.

Previously I have decried the improper use of irradiation as I have seen its bad results. Certainly there is no place for the careless, the casual, the inadequate use of radium or x-ray. Improperly used they may carry the patient past the time when other methods might cure, and they may be the easy methods of exploitation and negligence. Some cases treated again and again unsuccessfully over periods of years by x-ray, when they could have been destroyed early and quickly and easily by diathermy, make one feel that

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* From the Northwestern University Medical School and Cook County Hospital.

the profession needs education as well as the laity. If radium is inadequately screened, especially near bone and cartilage, terrific pain may follow its use.

What constitutes proper irradiation is too controversial to be discussed here. It is not the laying on of a small amount of rented radium improperly screened by one not trained in its use, or the poor placing of unsuitable needles which may burn out local scattered areas of cancer as one might burn holes in a block of ice with a hot poker. It will approach the use of the maximum tolerated total dose of well filtered x-ray of high voltage as by the Coutard method with many daily small doses or the exposure to radium bombs containing up to 4 grams or the careful placement of radium element or emanation seeds so that the unseen elements of malignancy will be walled off and no part of the mass will escape effective gamma rays.

Diathermy after much irradiation, especially if the latter was given long before, presents great difficulty. The limits of the growth are not defined and far peripheral scar may harbor cancer cells. On account of impaired circulation, destruction is always disproportionately great and healing frequently poor.

Selection of Cases

In spite of all this certain cases are suitable only for irradiation alone or with diathermy and I shall discuss briefly the selection of such cases under four heads: 1. Histopathology, 2. Location, 3. Clinical appearance and course, 4. Metastases.

1. The histological study is still very controversial and one finds eminent authorities with diametrically opposed views on certain points. At the Cook County Hospital we follow our pathologist, Dr. Jaffe, who believes that the microscopic appearance may give valuable information as to the radiosensitivity. It must be used with great caution however, as it has many possible sources of error. False value must not be given to moot criteria. Though it is debated, most authorities feel that radiosensitivity is roughly proportional to relative malignancy and immaturity of cancer cells. Broder's system based on relative amount of stroma and cellular differentiation has remained one of the simplest and best means of determining relative malignancy. MacCarty stressed lymphocytic infiltration, fibrosis and hyalinization. Hueper and his associates weighed twenty different factors.

Melinck, however, points out many doubtful factors of grading. Tumors of identical histological appearance may run entirely different courses. Histologic criteria are not well established. Cell types are sometimes almost impossible to determine. Cells may be polymorphous. Mitotic figures may be inconstant and there is growing evidence that amitosis or shortened form of mitosis may be important in tumor growth. In addition, as Melinck shows, a biopsy specimen may not be representative of the tumor as a whole; the character of the tumor may change with time, with blood supply, with irritation, infection, compression and other extraneous factors, and metastases may appear much different from the primary growth.

On the whole histology may give valuable indications for treatment. Quick and Cutter showed that so-called lympho-epitheliomas and transitional celled carcinomas yield well, for a time at least, to radium, although I have found they may be actually whipped up by diathermy.

Following the lead of Dr. Jaffe my clinical experience has been quite definite that cases with well matured cell forms, with much stroma, with hornification, or other indication of specialization yield well to electrosurgery and often poorly to irradiation. Basal cell carcinoma of course gives good results with either. Very immature cell forms, undifferentiated, with little stroma, approaching grade IV of Broder's yield much better to radiotherapy. Round and spindle cell sarcomas are usually sensitive to radium and a certain percentage of them may be so cured. Fibrosarcomas are better attacked by electrosurgery or the scalpel.

2. Location of tumors is an important factor in determining their operability. This may have to do with the kind of cells from which they originate. Favorable sites for electrosurgery are the skin of the face, ear, nose, and lips; the sinuses; the palate; alveolar ridge; the cheek; epiglottis and anterior third of the tongue. The more radiosensitive tumors arise generally from the fauces and tonsils, pharynx and posterior third of the tongue.

3. The clinical appearance may be quite as important as other factors in determining treatment. If a fissured infiltrating tumor with poorly defined margins presents itself we should be doubtful about results with electrosurgery. If it involves in addition an unfavorable location as the base of the tongue

or lymphoid tissue of the pharynx, we need not waste our time and energy on it.

If it seems of short duration—though history is often to be doubted—and it seems to have grown rapidly, radiotherapy probably should be chosen. If there is much fixation and induration, except in long standing cases, it is probably not for electrosurgery. If the tumor has well marked or rolled border, or is papillary or even fungating, it is quite likely to be amenable to diathermy.

4. Metastases even regional, I have been forced reluctantly to concede, usually mean defeat for diathermy. Occasionally a small gland may be removed and the original growth successfully destroyed, but I doubt that more than palliation in such cases can be secured except rarely by coagulation. If the original growth is small without sign of local tissue reaction especially with large glands radiotherapy only is likely to be of avail. If there are general metastases seldom can we hope to do anything worth while.

We may say then if a tumor is of a relatively mature type, located in resistive tissue, of slow progress, of an appearance denoting relative limitation we can attack it by electrosurgery with hope of good results. If just the opposite obtains we should yield it willingly to irradiation and leave our energies for more likely material to the great improvement of our personal morale and of our statistics. The greatest problem now is to know precisely what to do with the intermediate cases. Certainly many of them will respond best to a combination of electrosurgery and irradiation and further experience will show us what to do here.

Many of these cases may yield excellent results with a combined technic with pre-operative and post-operative irradiation. A carcinoma of the piriform fossa seemed too extensive for diathermy; its gross and histologic appearance was of an intermediate grade. Gold radon seeds were used with marked shrinking but without disappearance of the tumor. One month after implantation this mass was coagulated with good healing and the patient is apparently well. In all cases after electrosurgery I believe the regional gland area should receive radiotherapy.

Treatment as Regards Location of Tumors

The treatment of various regions may be briefly sketched. Carcinoma of the skin is a particular field for diathermy as it is easily

accessible, usually relatively benign, gives metastases late and unless great involvement makes considerable mutilation necessary, heals with a minimum of smooth scar. Nearly always I use the biterminal coagulating current even for small basal cell carcinomas. If on the lids, or if the growth is very small, or if of a precancerous type, a desiccating monoterminial current may be used on account of the lack of scar. Involvement of the auricle is easy to underestimate, and if it is extensive or of long standing, one should not hesitate to sacrifice the external ear and canal.

Carcinomas of the antrum as New showed, yield well to heat and even of a relatively anaplastic type, give late metastases. Operative exposure should be adequate. Last year I reoperated three cases with a Ferguson-Nelaton incision that had previously been treated through the canine fossa. I usually use the external route on account of the perfect inspection it gives.

Cancer of the lip should be treated by wide wedge resection for the relative safety and better cosmetic results, but the technic of Pfahler with destruction by desiccating diathermy followed by intensive irradiation appears to me admirable.

Cancer of the tongue if on the margin, tip or anterior one-third, especially if papillary, yields well to diathermy. If fissured, deeply ulcerated, infiltrating, and if on the base or posterior third it had better be left to irradiation.

Our carcinomas of the tonsil and pharynx have been usually extensive when first seen, of a very malignant histological type, usually with glands. Certainly we can not get such results as those reported from the Memorial Hospital and elsewhere with irradiation. Carcinoma of the epiglottis is easily destroyed by coagulation or removed by the cutting current.

I once had much enthusiasm about diathermy in the larynx, but now believe that where extensive involvement of the cartilage occurs, except as a palliative, it is not so good. For destruction of very small growths on an unfixed cord or for further protection on the raw surfaces left after a St. Clair Thompson laryngofissure, it is an admirable form of therapy.

Harmer and his associates report results in the larynx with radium after window resection of cartilage that compare well statistically

with the best surgical results. Here grading and selection of cases for radium may give better results with a minimum of danger, and mutilation and the least interference with voice and airway.

I have used diathermy in the esophagus after the methods of Wright and Hesse with only slight palliation, and with my own method after a preliminary pack with encouraging results, but have not been able to add any to the very rare reported cures.

Even in cases where electrosurgery is not primarily indicated, there may be special indications for its use. Hemorrhage from a granulating mass may often be controlled at least until the shrinkage and vessels sclerosis after irradiation has time to occur. Pain especially following improperly screened radium near bone or cartilage may be markedly lessened by the palliative destruction of ulcerated or involved areas. Improved food taking may follow destruction of a hypopharyngeal or

palatal mass not truly operable, and the airway not sufficiently opened by a tracheotomy tube may for a time be kept free by coagulating tracheal or neck masses.

Conclusions

Though as yet we have taken only a few of the outposts in this desperate battle, as experience accumulates, technic is perfected, unsuitable cases are given to irradiation, my enthusiasm for surgical diathermy grows. I have hope that in time the enemy's impregnability may crumble before the united allies of irradiation, electrosurgery and systemic attack. As in early times battle was made by massed forces and with primitive weapons and now with great refinements each arm and mechanism has its own highly specialized part, so in cancer we are learning that each instrumentality has its own field or is an ally to other means.

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(For discussions turn to page 350)

CANCER OF THE TONGUE *

W. H. SCHMIDT, M.D.

PHILADELPHIA

The treatment of carcinoma of the tongue requires a careful study of all the factors in each individual case, before a definite plan of therapy can be undertaken. When the seriousness of the disease is appreciated, it is obvious that early diagnosis is a prime requisite. The tongue being composed of muscles in constant motion, easily displaces the cells and early metastasis is the rule. The lymphatic supply is rich, and while distinct metastasis is very infrequent, the numerous glands in the neck, both superficial and deep, provide ample foci for metastatic growths which greatly complicate the treatment. Early diagnosis should be possible in most cases, because of its visibility and early symptoms, but in spite of this, we see all too many cases, which, on first examination, are well advanced.

The pathology of cancer of the tongue is simplified by the fact that it is practically always the squamous-celled variety. The degree of malignancy, however, varies widely,

depending mainly on the differentiation of the cells in the tumor. The well-differentiated cell, almost normal in type, and showing numerous cell nests, or epithelial pearls, is the least malignant, while the anaplastic or embryonal type is the most malignant. In between, are all degrees of variations.

Cancer of the tongue is predominantly a disease of the male sex, with only about 15 per cent occurring in the female. It is very rare below twenty years of age, but from forty years on, it appears more frequently and it is seen, even until advanced age. The majority of cases occurs anterior to the circumvallate papillae and only a small portion involves the posterior part of the tongue. Either side may be involved with equal frequency, and it is not uncommon to see it on the tip of the tongue.

Etiology

Cancer of the tongue is rare in a clean mouth. Oral sepsis, itself, has been held as a cause of cancer, and certainly, if it is not a

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cause, it is a complicating factor. Decayed, irregular and jagged teeth and poorly fitting denture can be traced as the initiating cause of many cases. Acute injury is seldom a cause, but chronic irritation, resulting in ulceration, is frequently found to be one.

A large percentage of tongue cancers occurs in individuals who use tobacco excessively, and in the human mouth, it certainly is a factor in the development of cancer. Leich,⁽¹⁾ McNally⁽²⁾ and Boger and Loomis⁽³⁾ were unable to discover a cancer-producing substance in tobacco, but it is possible that the irritation, combined with oral sepsis and other factors, is quite sufficient in many cases.

A positive Wassermann is observed in many cases. This frequently leads to an erroneous diagnosis, resulting in a loss of time and stimulation of the growth, by leucic treatment. It should be emphasized that cancer and syphilis can and do frequently exist in the same patient. Any case that does not respond to adequate antileucic treatment in a reasonable time should be reviewed as to diagnosis and the possibility of cancer. It is the sequelae of syphilis that is most important in the development of carcinoma. Such conditions as leucoplakia, glossitis, and the scars and fissures resulting from healed syphilitic lesions, form areas of lessened resistance, and any form of chronic irritation can easily cause them to break down into indolent ulceration which readily undergoes malignant changes.

Too frequently these indolent ulcers are treated by caustics which simply increase the liability of malignant change or increase the rapidity of growth of an already malignant lesion.

Symptoms

The first thing noticed by the patient is a slight discomfort, usually unaccompanied by pain. Frequently a tumor or a small ulceration is noticed. Pain is infrequent and is generally a late symptom. Ear ache is often a very early symptom and may be noticed soon after the tumor is seen. If the growth ulcerates early, there is more apt to be pain in the tongue, and the ear ache increases proportionately. Pain, as an early symptom, is very unreliable and many cases reach an advanced stage without it being a prominent factor. The late symptoms, such as salivation, bleeding, swelling and foetor of the breath are characteristic, and of value only as indicating an advanced stage of the disease.

Glandular involvement varies greatly as to rapidity, extent and course. Fairly advanced carcinoma has been observed without apparent glandular involvement, but eventually, metastasis occurs. The papillomatous type is slower in involving the glands, while the ulcerated and indurated type is usually rapid. Even after the local lesion has healed, late glandular involvement may occur. The following case is an example:

J. M. Age 55. Developed an ulcerated lesion of the side of the tongue and pillar of the tonsil. No glandular involvement found. The lesion was destroyed by the electrothermic method and healed perfectly. Appropriate radiation was given to the neck for a period of one year. The patient returned after three years, with the mouth still healed, but an enlarged cervical gland.

It must be realized, that apparently healthy necks may have glandular involvement of the deep cervical chain, and metastasis has also been found just above the clavical, with the rest of the neck clear, due to a direct drainage to these glands from certain portions of the tongue. The usual course is involvement of the parotid or submaxillary gland and extension down the chain.

Glandular involvement is very uncertain and irregular, but when it does occur, is of the most serious import. Occasionally, enlarged glands are due to a simple infection and disappear with the healing of the ulcer, but this is rare and is not to be depended upon in any case.

Treatment of the Local Lesion

While every case of cancer requires treatment, not only of the local lesions, but also of the glands, it is best to consider the treatment of each separately.

A biopsy is of great help in determining the treatment to be applied. This should only be done when we are prepared to proceed immediately with the treatment. A frozen section, followed by routine tissue section, gives valuable primary information. Where a biopsy is not possible, or considered dangerous, valuable information can be obtained by examination and history. The anaplastic lesion is the type which is most susceptible to radiation therapy, and is usually rapid in growth, showing a heaping-up of cells, with early ulceration and bleeding.

Where the history or biopsy indicates this type of growth, treatment should be started with radium, with the hope of entirely eradicating the disease, or at least, of greatly reducing its size. Application of radium, by

means of the pack, has been condemned by some prominent authorities, but the use of heavily filtered radium for long periods, has proven valuable. The author has an application with 4 mm. lead filter, on the treatment surface, and 8 mm. of lead on all other sides. An application of ten hours, with 100 m.g. of radium can be made without much reaction. It is possible to treat several areas and sometimes crossfire from the sides. If the growth is radiosensitive, there will be marked retrogression or complete disappearance of the growth.

The use of gold radon seeds has a definite place in therapy, particularly in small lesions. The difficulty of a uniform distribution, in large growths, is a decided disadvantage, and in such cases, seeds are seldom successful. Another fact that should be recognized, is the danger of leaving in cancer-infected areas, a foreign body, which must necessarily produce a certain amount of irritation. A considerable advance has been made by the use of platinum needles containing from 1 to 2 m.g. of radium. These needles vary in length from 9 mm. to 33 mm., and with a wall thickness of .5 to .65 mm. Practically all beta rays are screened out by this latter filtration. It is possible by these needles to surround completely a lesion with a source of radiation, which is of low intensity and can be continued for a period of time up to seven days. This technic is more effective, as it irradiates more cells during the period of mitosis, when they are most susceptible. There is, however, the danger of dissemination of the disease, by the trauma of introducing the needles. The needles are fairly large and produce considerable traumatism, necessarily opening blood and lymph spaces. It must be realized that those tumors that are radiosensitive will respond best and that certain tumors are decidedly resistant and will not yield. Regulation of dosage is important in this respect.

Experience shows that the first application of radium is the most important, as the greatest effect of radium on the tumor is due to the destruction of its blood supply. Therefore, effective cell destruction cannot be obtained in relatively avascular tumors, or in recurrence following radium treatment. Due to the lack of blood supply and fibrosis there is very apt to be necrosis.

Biopsies⁽⁴⁾ taken as a routine on cured cases of basal cell neoplasm of the skin, have shown,

with great regularity, the presence, in the deeper layers, of a few remaining cells. This raises the question as to how complete is the cure by radium. It certainly means that these cases must be watched most carefully for a long period of time after apparent cure, and that the possibility of recurrence must be emphasized, particularly if irritation is allowed to continue.

The following case illustrates this and several other points mentioned above:

G. B. Age 50. Patient has had leucic history. Has had fissure on tongue for a long time. Six months ago tumor developed, and now involves the anterior two-thirds of tongue and is elevated $\frac{1}{2}$ inch. There is not much infiltration. Slight enlargement of the glands. Radium treatment of 100 m.g. filtered through 4 mm. of lead, for ten hours, to three areas was given. One month later mass entirely disappeared. Fissure remained. Two months later, there was slight induration at anterior edge of fissure. Radium treatment of 100 m.g., ten hours, with 4 mm. lead filter was given again. In one month entirely disappeared. Later an ulcer in the fissure began. Reapplication of radium had no effect. Anterior two-thirds of left side of tongue was removed by electrothermic method. This healed perfectly and there has been no recurrence for two years. Glands of the neck treated by external radiation and are now in perfect condition.

If a biopsy shows a well-differentiated type of cell, or the history indicates a slow-growing tumor, without early involvement of the glands, it is questionable whether it is advisable to depend too much on radium as the best method of treatment. In order to destroy this type it is necessary to give a destructive dose, as the resistance is almost that of the normal cell. This means a very marked effect is produced on the blood supply and the surrounding tissue is devitalized. There is no question but that nature produces a defensive reaction around the growth, and excessive radiation viciates, to a considerable extent, this effort. In some cases, sloughing results, and due to the effects of radium on the surrounding normal tissue, is very slow in healing and painful. For these reasons, when a destructive action is necessary, it is better to depend on the electrothermic method, which will destroy tissue, under absolute control, without opening the blood and lymph spaces, and which increases, rather than diminishes the natural reaction of the surrounding normal tissue. Furthermore, there is less danger of leaving cancer cells to produce recurrence. Frequently, following radiation, the delayed

healing and fibrosis masks recurrence until the growth has produced considerable involvement, whereas, with the use of the electrothermic method, it is possible to discover any remaining disease as soon as the slough separates, which is in about ten days, and reapplication of the current is in no way contraindicated, as it would be with radium.

All easily accessible lesions, especially when small, are treated best and most safely, by giving a thorough radiation with the 4 mm. lead pack, followed in a day or so by destruction of the growth with the electrothermic method. This certainly gives the patient a double chance and lessens the likelihood of recurrence.

Local anesthesia is not used, due to the danger of spreading the disease, and the possibility of interference, due to causing pain to the patient. All cases are treated under general anesthesia, either ether alone, or avertin, with or without ether. The danger of igniting the ether must be borne in mind, and after the patient is thoroughly anesthetized, the ether is removed from the room, and the operation can start almost immediately.

The bipolar current is always used and the technical procedure is the same as that used by the surgeon. A line of destruction is first made around the growth, thus cutting it off from the healthy tissue, and shutting off the blood and lymph spaces. Then the growth is systematically and thoroughly destroyed. It is then possible to remove the tumor as a dead mass, by cutting through the coagulated area. The heat, necessary to destroy the tumor penetrates for a considerable distance beyond the area actually destroyed, and seems to devitalize cells, not actually destroyed by the current.

Nature sets up a natural reaction around this area and numerous lymph cells surround it. The slough separates in a week or ten days, and as the surrounding tissue is not devitalized, healing takes place rapidly, leaving a soft, pliable scar. Cancer tissue remaining is easily recognized because of the lack of fibrosis in the surrounding tissue.

The treatment of the lymph glands is of greater importance than that of the local lesion itself, because in the vast majority of cases, the local disease can be made to disappear. The outcome of the entire case depends upon the success obtained in treating the glands of the neck.

If the glands are not involved, they should be thoroughly treated by external radiation with either radium or x-ray. The initial treatment should be as thorough and complete as possible. It must be followed up by further radiation during the next six months, after which, treatment is lessened or stopped, and careful watching pursued for several years. If the glands do not enlarge, it is better not to give excessive treatment, so that, should metastasis occur, the skin of the neck will be in good condition to stand further intensive treatment.

If the glands are already enlarged, it is hardly likely that surgical removal will be of much avail. After many years of observation and experience with various procedures, such as radiation, followed by removal, either surgically or by the radio-knife, or destruction by the electrothermic method, the author has found that complete dependence on radium and x-ray, produces results equal to or superior to surgical removal.

When the glands are enlarged, radiation must be used to a sufficient extent to destroy completely all diseased tissue. This is best accomplished by implanting radium needles for a sufficient length of time to produce the desired effect. The author uses steel needles, containing 10 m.g. of radium, employing sufficient needles to surround completely the gland, and radiates, at least, from twelve to twenty-four hours. If judgment has been good, the gland is converted into a hard, fibrous mass, which seldom gives further trouble. If needles containing a small amount of radium are used, the time limit must be increased accordingly.

If each individual case is carefully studied, and good judgment used in each case, results will improve accordingly. It is a great mistake to place entire dependence in any one method. All methods of value should be studied, and used according to its indication, and frequently better results are obtained by a combination of two or more methods in a given case.

Summary

1. Careful study and planning of treatment are necessary in each case.
2. Anaplastic lesions respond best to radium.
3. Recurrence after radiation should be treated by the electrothermic method.
4. All small and easily accessible growths

are best treated by the electrothermic method.

5. Well differentiated type of lesion demands destruction, which is best accomplished by the electrothermic method.

6. Complete dependence is placed upon radiation for treatment of the glands.

Medical Arts Bldg.

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Discussion

Papers of Drs. Clark, Kime, Galloway, and Schmidt.

Dr. J. Thompson Stevens (New York): If experience has ever taught me anything it is the fact that in the vast majority of cases, not only in malignancies of the sinuses and orbit but for almost any malignant disease of any organ or structure other than the simple basal cell carcinomata of the skin, the ultimate result does not depend so much upon the treatment of the primary lesion as it does upon the treatment of areas already involved or those apt to be involved in metastatic disease. No doubt there are some among you who are a little tired of hearing me talk about preoperative or preliminary irradiation not only of the primary tumor but of the tissues about such lesions, i. e., those tissues which are liable to become involved with metastatic lesions. For years I have stressed this point. Therefore, almost always treatment is begun in my clinics with thorough preliminary roentgen or radium pack treatment of the primary lesion and the areas about them. Generally from one to two weeks is necessary to complete this treatment, i. e., this treatment is completed at about the time that the superficial structures are beginning to show radiation effects. Two weeks is a very short time in the life history of a malignant process. The benefits are so well worth while from this preliminary treatment that it is felt that no valuable time has been lost by the treatment, in fact, and I feel very strongly about this, it has seemed often life saving.

One very important result of this preliminary treatment is exerted upon the tumor itself. Microscopic examination of the specimen when the details of the treatments have been well executed, shows actual destruction of many of the cells with an increase of protective scar tissue formation, other cells appear abnormal malignant cells, i. e., they are called sickened cells. Upon transplantation these cells following preliminary irradiation either will not grow at all or they will grow only with great difficulty on account of lowered resistance or decreased vitality.

Another very important result of this preliminary treatment is exerted upon metastatic lesions and upon areas likely to become involved in metastatic processes. Often a node will disappear completely within a few hours after preliminary irradiation. Such a lesion was not a malignant metastatic lesion but only an inflammatory one. Such an observation changes one's prognosis. In the true metastatic lesion the nodes are frequently more sensitive than the primary growth, and hence it is most gratifying to see gradual improvement and final disappearance under further postoperative irradiation. And lastly an area that has been thoroughly irradiated preliminary to operative procedures will often fail to permit a metastatic lesion to develop even though live malignant cells are transplanted into it.

Dr. Erwin P. Zeisler (Chicago): The essayists have shown what can be accomplished in the treatment of cancer by careful selection of cases, by curette, by correct surgical and radio-technic and by the proper application of other modern methods to combat this dreaded disease. There is no question that electrosurgery has today largely replaced scalpel surgery in many types of cancer.

The three great advances that have been emphasized today in this symposium have been, in the first place, that a careful selection of cases must be based on the results of the biopsy and of the cell growth. Often the histologic picture will be the determining factor in deciding on whether to use radium, x-ray or the electrosurgical methods.

The limitations of radium therapy have been well brought out by the essayists. There isn't any question that the dangers of using radium about cartilage and bone have been emphasized. The danger of radium necrosis, the prolonged suffering that is brought on by the improper use of radium in many cases of intra-oral lesions should also be emphasized.

The current use of radium today necessitates armamentarium far beyond the possibility of the average practitioner to have under his control. We have found in carcinoma of the skin about the head and neck that the basal-cell type should be cured in 95 per cent of the cases, and in about 70 or 75 per cent of cases the squamous type should be cured with a proper combination of methods.

Within the last few years I have added electrosurgery to my armamentarium. As I review my results, there isn't any question that certain cases are far better treated by electrosurgery than they are with radium.

In my early work I used radon seeds in the treatment of a limited number of cases of cancer of the tongue. I used unscreened glass, radon seeds in a number of cases, and not only were the patients cured, but I was cured. I never used radon seeds again because the suffering that was entailed by this method of treatment is far too great for the average patient to endure. There are disadvantages in using gold radon seeds in intra-oral lesions. You leave a foreign body which may cause trouble later on, and very often a persistent pain is experienced by these patients lasting for many months.

The electrosurgical method has certain advantages over the use of radium in many of the intra-oral cases. It is only by careful selection of cases and careful study that we will improve our statistics.

Dr. Albert F. Tyler (Omaha, Neb.): We sometimes see patients in whom electrosurgery is not practical because of the location of the lesion. If it involves the entire lateral wall of the pharynx and the palate and comes out over the mandible, then we can use either external radium applications or high voltage x-ray treatment to great advantage.

I had a peculiar experience in the last year that I should like to report, to see if any of you have ever met a similar situation. It was a new one for me. A man had carcinoma of the tonsil. I applied radium in the pharynx directly against the tonsil. In order for him to be comfortable during the application, he lay down on the opposite side. Saliva kept drooling out of his mouth on the opposite side while the applicator was in place. When the reaction appeared, very much to my astonishment, the whole portion of the tongue and the inside of the cheek and gum where the saliva had rested were burned by radiation. We had protection on that side so we knew the radiation was not directed that way; it was directed opposite. The patient is quite a physicist, and his explanation, which I think may be a good one, is that the oxidation along the edge of the surface of this fluid in his mouth became radio-active and burned the tissues. I think that might be the explanation.

Dr. William E. Ground (Superior, Wis.): I believe in giving cancer the heat treatment just as early as you can. I think in electrosurgery we have an ideal way of applying it.

In malignancies or pre-cancerous lesions, if we may call them that, in the mouth, the leukoplakias are very nicely treated by the desiccating current. I have seen several cancers of the lip that I have treated by electrosurgical methods after radium therapy had failed.

Dr. Oscar B. Nugent (Chicago): It has been exceedingly gratifying to us all, I am sure, to see the rapid strides that have been made with the use of electrosurgery in these conditions. I have watched the development on the eye. It sort of eliminates, to a certain extent, the use of radium in certain conditions. It is very nice to see a tumor, if it is radio-sensitive, melt away under the use of radium. Still, at the same time we are not cognizant of the amount of metastases that have already taken place. I think electrosurgery is much more beneficial in many of these patients.

Dr. Thomas C. Galloway (closing): Most of us here are enthusiasts for electrosurgery. We do not get the point of the discussion if we leave radium out of it too much, because only by turning over to radium those cases which are proper cases for radium, the malignant, radio-sensitive tumors, are we going to get the results in our selected cases that will make us happy and make our statistics good.

Dr. William L. Clark (Philadelphia): We have the choice, of course, of resecting the glands of the neck in every case of cancer of the lip or tongue, no matter how small they are, and a goodly portion of the surgical profession believes that is the proper thing to do.

Dr. Bloodgood of Baltimore is quite insistent upon doing a block resection of all the glands of the neck in any case that is likely to metastasize, whether the glands show evidence of involvement or not.

Whether there is more metastasis after block resection than with radium treatment, I am not prepared to say; it recurs after both.

By the way, I do treat every case by radium, that is in the neck, but I remove the primary lesion by the coagulation method. But when that appears, I feel that interstitially the use of radium is better than the surface application. I immediately get busy and use my radium needles right in the depths.

My practice is not to make an oblique incision and to try to pack with gauze. It is possible to go down as deeply as desired in the neck, with a very narrow scalpel and just get sufficient opening to evacuate the gland, which many times will shrink down, and then maintain that drainage, not by means of gauze but by means of very thin silk-worm gut. You will be able to maintain your drainage permanently and give the patient a great deal of comfort. Patients are very much more comfortable that way than they would be by a large incision and the packing of gauze, or by leaving them alone.

With the small incision, it is also possible to insert a radium applicator down there at some future period. As Dr. Schmidt well said, the first treatment is the big treatment. If you don't get results with one dose, you can't expect very much. The other treatments are supplementary and not active ones, for the reasons that he very well told us.

Dr. Edwin N. Kime (closing): We seem to be rather uniformly agreed as to the value of electrosurgery as an adjunct of operative surgery, combined with radiation.

The problem of operating a supposed metastasis in the neck has been, to me, a very serious one. We have made many mistakes in operating in the earlier stage of our work, which we believe have been corrected by doing the more radical procedure of preliminary ligation followed by block resection.

With respect to the value of preliminary irradiation. Although we have seen many failures following the use of both x-ray and radium for squamous cell cancer, particularly of the tongue and buccal mucosa, we have felt that that preliminary irradiation has been of some value to us, because our best results have been in those cases in which we were able to combine both electrosurgery and radiation.

We should use both methods with the same degree of earnestness as if we were depending upon each method alone to bring about our results. When we are dealing with a neglected or an extensive malignancy in the neck, we are

dealing with one of the most fatal conditions which I know.

Dr. William H. Schmidt (closing): The question of the treatment of the glands, I think, is based entirely upon a misconception in many cases. Certainly you are not treating a gland alone, if the malignancy is extending from the mouth, or some other part of the head, into the glands of the neck, and the lymphatic channels are involved. If you go in, you are certainly cutting into tissue which is already malignant.

If you are going to do anything at all, I think Dr. Kime's method is the proper one, to entirely eradicate all tissue in the neck.

To remove the glands themselves simply opens up the lymphatic channels. The first thing you know the neck tissues break down, and your patient is in a pretty bad condition. If there is going to be a recurrence, or if the glands are going to persist and increase, your patient is in better condition under radium treatment than with an open wound in the neck.

A NEW TYPE OF WATER COOLED QUARTZ ULTRAVIOLET APPLICATOR FOR ORIFICIAL USE *

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The device here described is presented in the belief that an applicator giving adequate and uniform lateral ultraviolet radiation for orificial use with the water cooled ultraviolet lamp may find a place in the armamentarium of the profession. It is expected that such an applicator will broaden our field of treatment in such cases as bladder and urethral infection, diseases of the rectum, and vagina, abscess cavities and infected sinuses, and infections of nose and throat and the accessory sinuses.

A survey of the available applicators for these purposes shows a number of excellent devices, most of which, however, seek to concentrate the rays to a given area of more or less limited extent.

In the treatment of the above named conditions such applicators were found to be inadequate, for it is recognized that we need here, not the *concentration* of rays to a small area, but the *dispersion* of the therapeutic rays to the whole of the interior of a sphere, as for instance in the bladder, or in abscess cavities. After much experimentation principles adopted in the present device were found to be the most efficient for our purpose.

This device consists of:—

First: A quartz cylindrical member to carry the ultraviolet rays along the central portion to the deflecting device.

Second: The deflecting mechanism, con-

sisting of small quartz elements placed closely together and in close approximation to the lateral walls of the central member.

Third: An outer thin walled quartz cylinder.

Fourth: A condensing device.

The rays travel along the interior of the central member, are caught by the small elements and deflected laterally in all directions, so as to form an even dispersion to all parts of the walls of the cavity to which it is applied.

When an ordinary rod applicator is used, the sides act as a mirror, the rays travel along its inside walls, being reflected back and forth. Should any portion of the side walls be moistened, as it would in being introduced into the body, the rays will be immediately attracted to the wettest places where it is in contact with the tissues, where they concentrate, and are therefore deflected through the side wall in an uneven and uncertain manner.

One advantage of the construction here described is that the deflection of the rays is accomplished *within* the apparatus, and *before* they emerge from the sides of the applicator. The rays are therefore not influenced by being moistened when in contact with the tissues.

From the above it will be seen that the rays to be dispersed are only the amount of those rays entering the apparatus at the source. As in the case of a small applicator, such as is required for use in the bladder, the amount is small, it becomes necessary to concentrate

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as far as possible all the rays emerging from the lamp.

To illustrate the problem of what is accomplished in the even and efficient lateral distribution of the rays in such a device, an area opposite the side of the applicator, of one square inch at approximately one and one-half inch distance, would subtend an area of 30 degrees of the circumference, or one-twelfth. In other words such a given area would receive one-twelfth of the energy being given off at the side of the applicator. This was tested by means of a Burt photometer, and found to check.

Various forms of the applicator are designed to meet the various conditions to which it may be applicable, as follows:—

1. For the female bladder, also for small abscess cavities, a cylindrical applicator of 9 mm. diameter, or about the size of a number 30 French sound, and about two inches in length, the conducting portion of sufficient length to traverse the urethra.
2. For the rectum and vagina or larger abscess cavities, a similar applicator of larger dimensions.
3. For use in the nasal cavity, and for the

treatment of the accessory sinuses. Here a flat applicator about 6 by 15 mm. has been designed, with the dispersive elements arranged at the end and on one side so as to disperse the rays over one-half of the circumference. It is designed to be applied in the nostril along the turbinates, with the dark side against the septum, dispersing the rays to the end and laterally, in the direction of all the accessory sinuses. That portion opposite the dispersive elements (or the septal side) has been metallized, so as to form a mirror, thus increasing the lateral deflection toward the sinuses.

It is to be understood that this presentation is in the nature of a preliminary communication. Clinical application has not been sufficient to enable us to give a report of cases. For example, a case of chronic interstitial inflammation of the bladder wall has been seen by the writer just previous to coming to the meeting. Only two treatments have been given, with enough relief of symptoms to be encouraging.

Spectrographic photometric, and bacterial studies are in progress, to be reported later.

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PARAFFIN TREATMENT OF CHRONIC ARTHRITIS *

With Special Reference to an Improved Type of Equipment

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The extent of the disability caused by arthritis and related diseases is exceeded only by accidents, which cause but five per cent more invalidism; while tuberculosis accounts for less than half as much and cancer less than one-tenth.

In contradistinction to the magnitude of the problems presented by these sufferers we find, (according to well authenticated figures), only about four hundred regular physicians and eight hundred qualified technicians who specialize in physical therapy. It is, therefore, not to be wondered at that it has taken so many years to get chronic arthritis

out of the ranks of the so-called incurable diseases. Particularly is this true when we consider the position of outstanding importance that physical therapy occupies in successful programs of treatment.

After what has been accomplished already, it can be expected that regardless of the advances and refinements in other therapeutic methods that most certainly will be evolved, physical therapy will continue to play a major rôle in composite programs of treatment — which is no small tribute from one who has recently developed a new adjunct in the form of a soluble antigen. As we survey in retrospect our efforts to banish the suffering and disability that have followed in the wake

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of this group of diseases we must confess that many of our earlier failures were the result of worshipping at the shrines of false gods. In looking for an Aladdin's lamp by means of which we might suddenly achieve recovery for these sufferers we often permitted our enthusiasm to get the better of our judgment, and in the end learned from sad experience that the "longest way 'round was the shortest way home."

It is obvious that physical therapy cannot be viewed as a substitute for focal removals, or other fundamentals of successful treatment. But, on the other hand, it has been abundantly demonstrated that even the removal of foci of infection merely *initiates* but does not *constitute* treatment.

The modern concept of comprehensive and adequate composite programs of therapy embodies a recognition of the fact that there is a number of more or less distinct pathological and clinical types of arthritis and that each kind presents special therapeutic indications, although certain measures may be advantageously employed in all varieties.

As a rather broad generalization the following treatment factors merit consideration:

1. Removal of the cause.
2. Rest.
3. Diet.
4. Elimination.
5. Climate.
6. Drugs, vaccines and antigens.
7. Surgery.
8. Physical therapy.

It is, however, to the importance of physical therapy that our attention is to be directed at this time.

To enter upon a detailed discussion of the innumerable ways and means by which physical therapy may be employed would greatly exceed the time allotted to me; but, in a general way, they may be classified under the headings of: Hydrotherapy, Colonic Therapy, Heliotherapy, Electrical Modalities and Electro-Magnetic Vibrations, Therapeutic Exercise and Massage. It may be stated, furthermore, that the objectives of physical therapy of whatever kind, embrace effects that are restorative, regenerative and rehabilitative.

More specifically, a conspicuous goal of physical therapy in the treatment of chronic arthritis is an improvement of circulation, from either a local or general viewpoint, or both. And in this connection the application of heat occupies a commanding position.

All of you are familiar with the usual methods of applying dry, moist, radiant, and other kinds of heat. The treatment of arthritis of the hands, wrists, feet and ankles, however, often presents special difficulties with regard to a satisfactory circulatory response by such procedures.

The fact that deformities of the finger joints often produce a degree of disability which, in economic importance, equals that of all of the other joints combined, provides the background for this paper.

Paraffin Treatment

Paraffin has been extensively employed abroad for many years, but has never achieved great popularity in this country despite the excellent results that have followed its use. Among the various reasons for this absence of enthusiasm for an extraordinarily useful therapeutic adjunct, one of the most important has seemed to be the lack of suitable, safe and relatively inexpensive types of equipment.

With the type of apparatus designed for laboratory use the patient is in considerable danger of receiving burns from contact with the paraffin container; moreover, the lack of an insulated surface upon which to rest the arms and legs makes their immersion both awkward and fatiguing. With these considerations in mind and with the objective of making more generally available a most valuable aid to treatment the Wyatt Paraffin Bath was designed; but before discussing the more important features of the equipment, a few brief comments relative to paraffin itself are in order.

We have in paraffin an exceedingly valuable means of treating arthritic feet, ankles, hands and wrists because it enables higher temperatures to be applied than is the case with solutions, oils, packs, foment, radiant heat, etc. The changes in the affected structures produced by paraffin are essentially those resulting from an increased blood supply to the immersed parts. Treatments are begun with the paraffin heated to a temperature of 118 degrees to 120 degrees F. The patient dips either hands or feet quickly into the bath and out, keeping the member rigid in order to avoid cracking the paraffin "glove" or "boot." This procedure is repeated six or eight times, or until a coating of about one-half inch of paraffin has been accumulated. The temperature of the paraffin is then increased to an



Fig. 1. This shows a patient using the hand and wrist bath. The comfortable position is secured by the use of a revolving stool with back rest. The left forearm as well as the right elbow are resting on the top of the bath which is thoroughly insulated. The facility with which a glove may be removed is also shown.

average of 140 or 150 degrees F., which, by the way is tolerated perfectly. The hands or feet are kept in the bath for an average period of thirty minutes. At the completion of the treatment the paraffin glove or boot is easily removed by stripping it off with the fingers. If it is desirable to facilitate or speed-up the coating process, the hand or foot may be dipped alternately into the paraffin and then into a vessel of cold water.

When the paraffin is removed it will be noted that there is an accumulation of fluid in the tiny insulating space that forms between the inner layer of paraffin and the skin surface; and this small space appears to provide the explanation for the ability of patients to tolerate what seem to be excessively high temperatures.

Evidence of the superiority of paraffin is of two kinds. First, the more prompt symptomatic relief, which lasts very much longer than when other means of heat are employed; and second, the more rapid return to normal of the affected structures which may be demonstrated by x-rays as well as by measurements of the increased range of joint movement.

The more important features of the equipment which I have devised may be seen in accompanying illustrations.

By thus providing a convenient, comfortable, safe and economical means of applying a high degree of heat to the affected structures, the disabilities heretofore occasioned by



Fig. 2. The appearance of a boot is well shown here. Note the thickness of the paraffin and the facility with which removal is carried out.

arthritic lesions of the hands, wrists, feet and ankles, have been greatly minimized. It must not be assumed, however, that the structural integrity of seriously damaged or ankylosed joints can be completely restored by paraffin or any other form of physical therapy.

Discussion

Dr. R. G. Snyder (New York): The melted paraffin wax bath was introduced into the practice of medicine by Colonel Littlewood of England, during the late war, as a method possessing particular advantages for the treatment of selected cases of chronic arthritis. The advantages of this method of treatment are that heat may be applied to an arm or a leg and easily borne by a patient at a temperature 20 degrees F. higher than that at which he can stand water on the skin.

It requires a temperature of 122 degrees F. to melt the paraffin. As a rule, the best temperature to utilize is from 128 to 130 degrees, although in many cases a temperature of 140 degrees F. can be safely utilized. Great care should be used in the treatment of scars or anesthetic areas as in these cases, severe blisters may occur. The disadvantages of the method are that only the arm to above the elbow and the leg to above the knee can be conveniently treated.

This form of treatment has been extensively

(Concluded on page 374)

ULTRA SHORT WAVE LENGTH ROENTGEN RAYS *

Problems in the Therapeutic Use

HENRY SCHMITZ, M.D., and HERBERT E. SCHMITZ, M.D.

CHICAGO

Distance radiation with roentgen rays is preferable to that with gamma rays. This is due to more homogeneous distribution of radiation intensities in massive and deep seated cancers. The treatment is rendered more effective from a biological point of view by the use of longer focus skin distances and large quantities of rays given off by a roentgen tube. The quality of the two radiations differs in absorption and production of electrons or secondary rays. Roentgen rays produced with 200 K. v. are absorbed directly to form unmodified scattered rays which change into electrons. Gamma rays form almost exclusively modified scattered rays due to the Compton effect. The primary ray impinges upon colloidal matter, gives up part of its energy, which becomes absorbed forming an electron. The modified primary ray may again impinge upon matter, again lose part of its energy, which again is absorbed producing an electron. The Compton scatter, therefore, causes a multiple modification of the primary ray and a multiple formation of electrons on absorption. The electron however produces the biologic reaction in the tissue and tumor cells. The formation of several electrons from a single primary ray, therefore, should increase the intensity of the biologic reaction. The difference in the biologic effects of the two kinds of rays may be explainable (1) by the modified and unmodified scattering; (2) by the formation of electrons, which is much greater in the latter than the former. Both are directly dependent on the wave lengths of the primary radiations.

Absorption of roentgen rays produced with 500 K. v. or higher proceeds almost entirely according to the Compton scatter. Hence it would be desirable in distance radiation therapy to use rays of ultra short wave lengths produced with 500 or more K. v. The higher the voltage the closer will the roentgen rays

approach the wave lengths of gamma rays.

The completion of the recently constructed Mercy Hospital Institute of Radiation Therapy offered an opportunity to study the problems confronting the radiologist in planning the installation of transformers and tubes of a capacity of 800,000 volts. The problems were mainly mechanical, physical and medical. Their solution is herewith reported.

The Engineering Problems

The engineering problems are concerned with the therapeutic application of the ultra short wave lengths roentgen rays. The treatment should be practical in execution and comfortable and safe to the patient and personnel. The problems are: (1) The time duration of treatment; (2) The position of the patient during treatment; (3) The supervision of the patient during treatment; (4) The protection of patient and personnel from the high tension current; (5) The adequate protection of patient and personnel from the stray and highly penetrable radiations; (6) Adequate control of voltage and milliamperes, and the vacuum in the tube.

The time duration of treatment with constant focus skin distances and voltages may be shortened within practical limits by an increase in the milliamperes. This was attained by a water cooling system which circulates from 60 to 90 gallons of tap water per minute through the target housing of the tube and maintains a constant temperature of about 80 degrees C. with a load of 10 to 30 milliamperes. High ampere loads enable us to apply within an eight hour day thirty-two treatments each of 300 r units with an intermission of 5 minutes between treatments. This is also an important economic factor as the charge per treatment can be placed within the means of the average patient.

The target of the tube has been tilted at an angle of 28 degrees. Because of this the tube could be placed in a horizontal position thereby making possible a reduction in the

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* From the Mercy Hospital Institute of Radiation Therapy and the Department of Gynecology, Loyola University School of Medicine.

height of the transformer room with a corresponding reduction in the height and the cost of the building. The target is placed in the ceiling of the treatment cubicle. The patient lies on a comfortable bed in a prone position. The bed can be raised to bring the patient up to the desired distance from the target of the tube. Accuracy in placing the axis of the radiation beam in the center of the port of entry and in maintaining the exact focus skin distance are assured without taxing the physical strength and comfort of the patient.

Supervision of the patient during the treatment by the physician and technician, without exposure to the highly penetrating rays, has been achieved by the use of a specially constructed periscope and heavy lead plates. The channel also enables direct conversation with the patient.

The grounding of the steel skeleton of the building, the water and steam pipes, the transformers and the tube has nullified all danger

from the high tension currents to patient and personnel. Heavy copper rods were attached to these parts and connected to copper plates 6 x 8 feet in size which were grounded in charcoal beds.

Adequate protection of patient and personnel from the roentgen rays has been accomplished by the liberal use of lead. The target housing is enclosed in a casket containing 14,000 pounds of lead and the walls of casket are of six inches of lead. The walls of the treatment cubicle which measures 10 x 6 x 7 feet contain 22,000 pounds of lead. The total weight of lead used in the building is 96,000 pounds. Photographic films placed just outside of the treatment room and in the control room do not become fogged, and charged electroscopes do not become discharged.

The control of the time duration of treatment is twofold and obtained by a telechron and a stop watch. The voltage is controlled by volt meters, sphere gaps and a Victoreen iometer; the ampères are measured by two

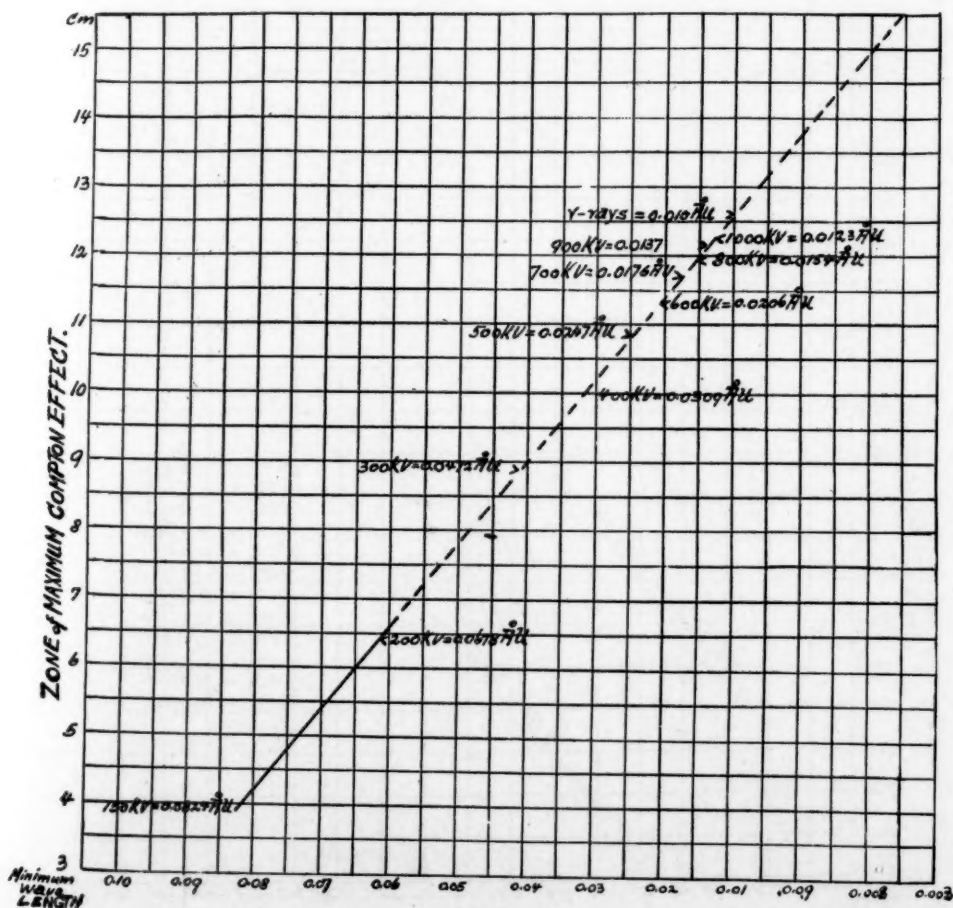


Fig. 1

independent meters. The vacuum in the tube is maintained by coarse and fine oil pumps and measured by micrometers in triplicate. All the accessory instruments are built into the control board and thus kept in constant view of the engineer. Observation of the installation during actual treatment for more than 1000 hours has demonstrated the perfect and ideal solution of the mechanical problems.

The Physical Problems

The physical problems comprise the distribution of radiation intensities in the depth and the determination of the zone of maximum absorption. The deep dose at 10 cm. obtained with the 500 K.v., 70 cm. F.S.D., 20 cm. squ. field of entrance and a filter of 1 mm. brass, 1 cm. water, 3 mm. copper, 1 mm. aluminum and 0.5 cm. bakelite is about 56 per cent, if the surface intensity is placed at 100 per cent. The deep doses vary only slightly with an increase in voltage—an ob-

servation established by Blackburn.

The zone of maximum effect of absorption was determined by Rajewsky. The values depend on the wavelength. If they are plotted against wavelength then a straight line is obtained. By extrapolation it is possible to read off the maximum absorption zone in centimeters for each wavelength. (See Figure 1.) The clinical application of the values enables one to choose the radiation which will place the tumor area within the zones of maximum absorption.

The Medical Problems

The medical aspects concern mainly the biologic reaction which is probably a function of wavelength, and of the radiation dose. A comparison of the immediate changes in the skin treated with 200 K. v. roentgen rays, 500 to 800 K. v. roentgen rays and gamma rays, provided the same biologic effect is attained as indicated by a superficial destruction of the epidermis, shows a slow healing, edema

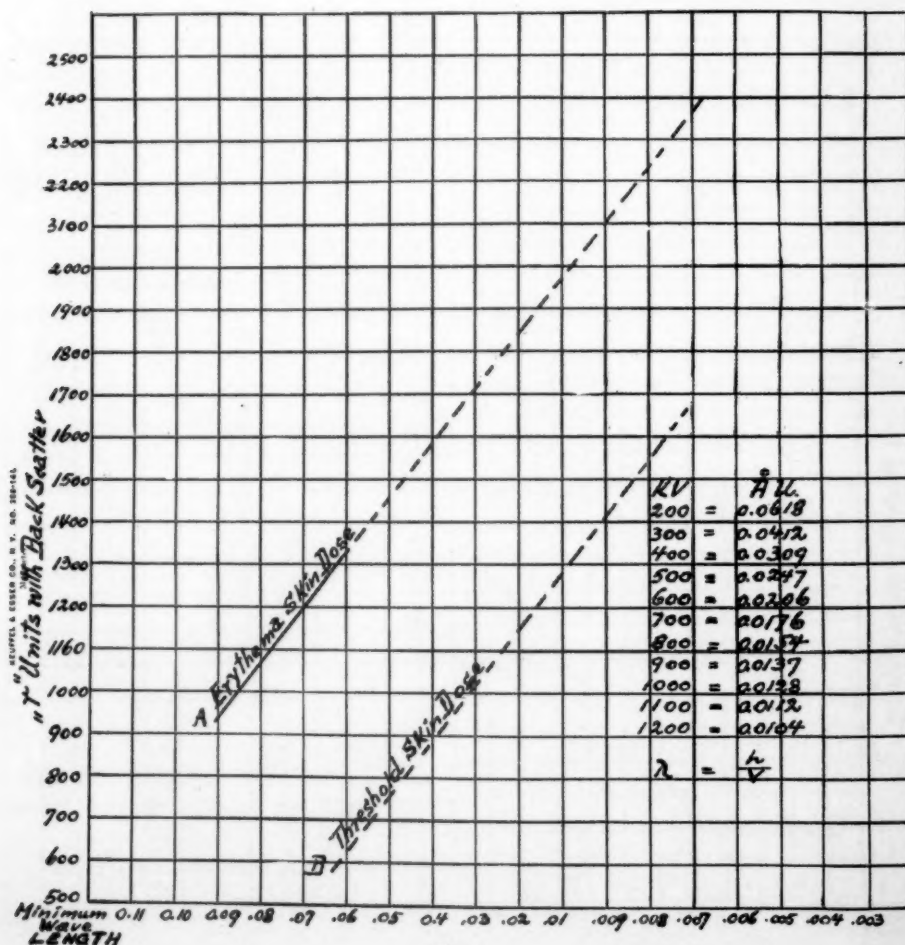


Fig. 2

and connective tissue formation with the 200 K. v. rays, a more rapid healing and normal elasticity of tissue with the ultra short wavelengths roentgen rays and gamma rays. The patients complain less of the after effects and are not inconvenienced by induration of the tissues. It is assumable to state that the characteristic reaction of the 200 K. v. rays is induration and heavy scar tissue formation, and of the shorter wavelengths changes in the epithelial cells. Observations made on the mucous membranes of the urinary bladder, the rectum and the vagina are not yet completed. The reactions so far observed are devoid of indurations, and the membranes remain elastic and soft.

The radiation doses were measured in r units with a condenser dose meter. The number of r units were determined from the values published by Glasser et al. The values also form a straight line if plotted against wavelength. By extrapolation the values may be extended to shorter wavelengths (as seen in Figure 2). Curve A represents the values in r with backscatter for the threshold skin dose; the curve B the values in r with backscatter for the erythema skin dose; and curve C represents the values in r with backscatter for the tolerance skin dose if the total dose is given in one sitting. For instance, for roentgen rays produced with 200 K. v. the threshold skin dose is produced with 630 r

with backscatter, the erythema dose with 960 r with backscatter, and the tolerance skin dose with 1575 r with backscatter. If the doses are applied in five fractions within 15 days, then 50 per cent more r may be given, and if they are applied in ten fractions within 21 to 28 days, then 75 per cent more r may be given. In other words, the values in r for the five fraction method are for the threshold skin dose 960 r, for the erythema skin dose 1375 r, and for the tolerance skin dose 2300 r; and for the ten fraction method applied over 21 to 28 days for the threshold skin dose 1050 r, for the erythema skin dose 1575 r, and for the tolerance skin dose 2625 r. The tolerance skin dose causes a lesion resembling a second degree burn with an almost total desquamation of the epithelium, however epithelization is complete but telangiectasia and leucoderma are latent results. This dose represents the highest radiation dose. Beyond it destruction is probably permanent.

The combined labors and consultations of architect, the electrical engineers, the physicist and the medical staff of the radiation institute made it possible to solve the many problems that concern the distance radiation method with ultra short wave length roentgen rays.

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PHYSICAL MEASUREMENTS OF ULTRAVIOLET RADIATION *

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Introduction

Physical measurements of ultraviolet radiation have two purposes: First, to aid the physician in selecting, among the various available light sources, the one whose distribution of intensity throughout the spectrum most nearly fulfills the needs of any specific case, and second, to contribute its part toward the extension of our understanding of photobiological processes.

Because of the present limitations of our knowledge of the effects of different bands of the spectrum, the first object can at the present time be realized only in part. As an instance of this, extensive research on the effect of ultraviolet in the production of the antirachitic effect or vitamin D⁽¹⁾ has failed as yet to produce any very satisfactory agreement as to the relative value of different parts of the ultraviolet for this purpose, except to fix approximately the upper wave length limit of the effective radiation.

As another illustration, although the relative bactericidal effect of different parts of the ultraviolet has been determined⁽²⁾ it is also known that very small amounts of foreign matter serve to protect the bacteria from exposure to the light and thus minimize its direct effect. In the application of ultraviolet for this purpose the beneficial results observed may therefore in some cases be largely due to such secondary effects as increase in the bactericidal power of the body fluids, or generally increased resistance to infection. There is some evidence⁽³⁾ that these secondary effects are due to different regions of the spectrum than those responsible for direct bactericidal activity.

The application of physical measurements of ultraviolet is thus seen to have certain limitations. Within these present limitations, however, it still has a considerable and increasing field of usefulness, and is probably

of greater value when its limitations are understood.

Methods

There are two general methods for the measurement of ultraviolet intensity. In the first a single band in the ultraviolet is isolated and its intensity measured either in absolute or more commonly in relative units. In the second^(4, 8) the intensities are measured in a series of adjacent narrow wave bands throughout the entire ultraviolet and preferably also throughout the visual and near infrared portions of the spectrum, from which a curve is drawn showing the distribution of energy throughout the spectrum.

The means of measurement by the first procedure may be photochemical, such as the change in color of a solution affected by light; photo-electric, as with the various types of photo-electric cells; or radiometric, involving the use of thermopiles. In the first two cases screens or filters may be used to limit more exactly the region being measured, while in the last case they are essential.

The measurement of erythema intensity falls properly in the first of the two classes. It, however, has a special position in this class. Not only does it to some extent take the place of such rapid measurements as may be obtained by the photo-electric cell or similar means of measurement, but, as has already been pointed out by Coblenz⁽⁵⁾, it is of special value in the practical application of light in showing, with any given individual, the limits of time and intensity of exposure that may safely be used.

The second type of measurement is the more fundamental because it permits comparisons not only of the same light source in different parts of the spectrum, but also of different light sources either throughout the entire spectrum or in any portion thereof that is of particular interest. Its most obvious limitation is that it can be carried out only in

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 15, 1933.

a properly equipped physical laboratory and requires considerable time to complete, as compared with the more rapid measurements according to the first procedure. These are of value, especially when based on the more fundamental data of spectral energy distribution, in checking up on a light source to determine its variation in intensity with distance, or in the case of such types of ultraviolet generator as may vary with age or operating conditions, in evaluating such variation.

Light Sources

If a solid material is raised to a sufficiently high temperature it will give off light, the percentage of radiation of shorter wave lengths increasing continuously with further rise in temperature. The use of incandescent solids for the production of ultraviolet has the serious limitation that they cannot be operated at a sufficiently high temperature to give off more than a very small percentage of ultraviolet. In the case of the tungsten filament incandescent lamp the highest temperature that it is practicable to use is in the neighborhood of 3,000 degrees C. In the crater of the plain or untreated carbon arc a temperature of about 800 degrees higher is attained, but even this light has a relatively small per cent of short wave ultraviolet, and its use for the production of ultraviolet is very limited as compared with the types of modified carbon arc described below. The radiation from the sun is similar to that of an incandescent solid at a temperature of about 6,000 degrees C., and with the attainment of this temperature appreciable amounts of ultraviolet are produced.

The most common method for producing high intensities of ultraviolet is by the electrical excitation of elements or compounds in the gaseous or vapor state, maintained by means of an arc or other type of electrical discharge. Under these conditions the light given off will commonly be limited to a few definite portions of the spectrum, appearing in a spectrum photograph as a series of lines or bands. It is therefore commonly called a line or band spectrum, as contrasted to the continuous spectrum of an incandescent solid, and is characteristic for each element or compound. Metals or their compounds are especially useful in producing high intensities in the ultraviolet by this procedure. Where the

physical condition of the material permits or requires it, the electrical discharge may be caused to take place inside of a tube of glass or quartz, as in the case of the mercury or neon tube. Another way to produce the characteristic spectrum is by striking an arc between two rods of metal, as is sometimes done with iron or tungsten. In this case the metal is vaporized at the tips of the rods and its vapor fed into the arc where its characteristic radiation is produced. It is possible by this means to produce a fair percentage of ultraviolet. Such a procedure, however, has two principal limitations; first, unsteadiness of operation, and second, the fact that it is limited to a relatively low current and intensity of ultraviolet.

The characteristic radiation of many of the metals can be produced without these limitations, however, by incorporating them in rods of carbon, between which an arc is struck. Under these conditions they will be fed into the arc as the carbon is consumed and will produce their characteristic "arc" radiation superposed on that of the carbon itself and in most cases completely overshadowing it, so that the light is more characteristic of the metal present than of the carbon itself. The intensity and distribution of light from the arc can thus be modified to produce a large variety of different combinations. Most of the elements whose physical condition permits their use have been tried in the carbon arc at some time or other. Many of the combinations that have been tried remain solely as laboratory curiosities and will so continue unless or until some practical use is found for the particular pattern of radiation which they give off. The most commonly used modifications are two: First, salts of cerium and the other elements commonly known as rare earths, which yield a high intensity of visual light together with a moderate ultraviolet intensity, and combinations of metals, including iron as the principal constituent, which give only a low intensity of visual light but a high concentration of ultraviolet.

Experimental Results

The data that are reported are given in the form of spectral energy distribution curves throughout the ultraviolet and visual portion of the spectrum with intensities plotted against wave length. Some of the curves include also the near or penetrating infrared.

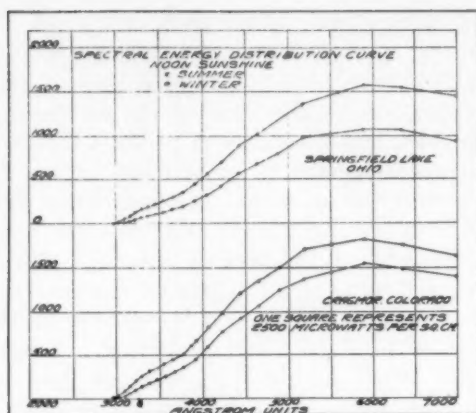


Fig 1

The intensity at any given wave length in such a curve is proportional to its height at that point, or more accurately, the intensity between two wave length limits is measured by the corresponding area under the curve. By this means it is possible not only to compare the intensities of two light sources in any given part of the spectrum, as in the erythema producing ultraviolet, but also to compare the shapes of the energy distribution curves throughout the entire spectrum.

The most common standard with which artificial light sources are compared is natural sunlight. Sunlight, however, varies widely in intensity not only throughout the day and year, but in different locations. A common basis of comparison is that of noon summer sunlight at low altitudes. However, the experience of physicians who have used heliotherapy at tuberculosis sanatoria has been that noon sunlight in summer is too intense for best results. Noon sunlight is not used until in the fall at locations of low altitude and in the winter at mountain stations. In selecting a sunlight with which to compare artificial sources, it was desired therefore to use the most intense sunlight which is considered acceptable as judged by the experience of heliotherapists. We were very fortunate in securing for this work the cooperation of two such sanatoria, each representing a typical location. The first was the Springfield Lake Sanatorium, under the direction of Dr. Clarence L. Hyde, which is located near Akron, Ohio, at an altitude of about 1,200 feet; the second, Cragmor Sanatorium, under the direction of Dr. Alexius M. Forster, near Colorado Springs, at an altitude of almost 7,000 feet. We carried out measurements⁽⁶⁾

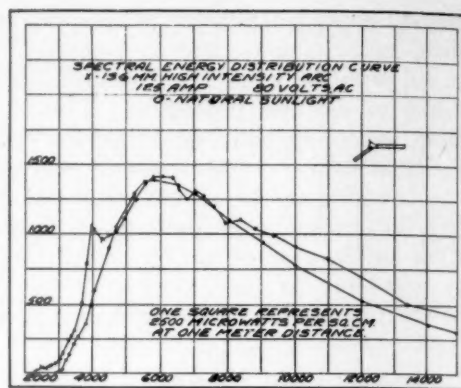


Fig. 2

of the intensity and spectral distribution of the energy of sunlight in both locations in the fall, winter and summer. The noon intensities found in the early fall in the Ohio location were about the same as in the late fall or winter in Colorado, and the average of these, which has been designated as "clinical sunlight," was taken as the basis for comparison with artificial light sources. The spectral energy distribution curves for noon sunlight at the two locations for summer and winter are shown in Figure 1. Going either from winter to summer or from low altitude to high, it is seen that the intensity increases throughout the entire ultraviolet and visible, but that this increase is greatest in the short wave ultraviolet. The intensity of the erythema producing ultraviolet of shorter wave length than 3130 Å. is about 75 per cent higher for noon summer sunlight at low altitude than for the "clinical sunlight" which we have used in our comparisons.

An artificial light source may be compared with sunlight in a number of different ways. One is, does it contain appreciable amounts of ultraviolet of shorter wave length than that found in sunlight? Most of the commonly used sources of ultraviolet do contain this short wave radiation which, if it is desired to make the light more like sunlight, can be removed by the use of a suitable filter or screen, such as Corex "D" or Vitaglass. They may also be compared on the basis of their comparative intensities as determined by production of erythema. If, however, the desirable effects of sunlight are not necessarily limited to its antirachitic or erythema producing properties, a more complete evaluation may be obtained by comparing the distribu-

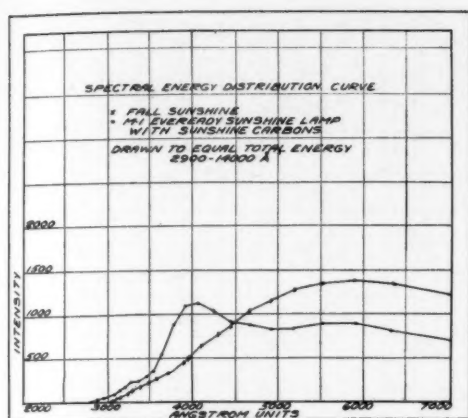


Fig. 3

tion of energy throughout the entire spectrum.

There is one type of artificial light source which does produce a very close approximation of sunlight throughout the entire spectrum. This is known commercially as the "high intensity" arc and is used in large searchlights and in the projection of motion pictures in the larger theatres. A comparison of the energy distribution of these two is shown in Figure 2. Throughout the main portion of the spectrum the two curves are quite similar. In the ultraviolet below 2900 Å, the arc contains a small amount of energy which is not present in sunlight. The use of a screen of Corex "D" with this arc to remove this part of the ultraviolet will make an even closer duplication of sunlight. Such a light, however, can have but limited application for medical purposes because of certain inherent difficulties in its operation in this field.

A fair approximation of the energy distribution of sunlight is given by the arc between carbons which contain cerium salts, known commercially as "Sunshine" carbons. Although its spectrum is composed of lines rather than being continuous as is theoretically the case with sunlight, there are so many of these spectrum lines closely packed together that the effect approaches that of the continuous spectrum of sunlight. At wavelengths shorter than 2900 Å, where the intensity of solar radiation is zero, the intensity of the "Sunshine" carbon arc is low, but still closer similarity to sunlight is produced by removing the small amount that is present with a screen of Corex "D".

As shown in Figure 3, this arc for a given

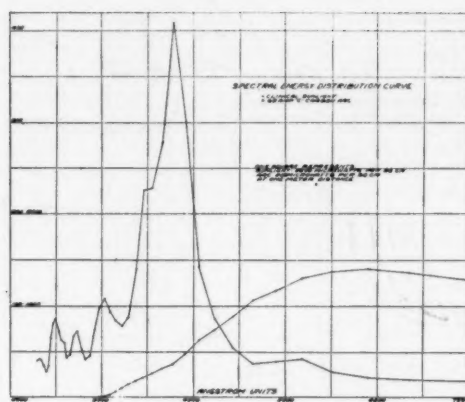


Fig. 4

intensity of visual light gives a somewhat higher intensity of ultraviolet than does natural sunlight. A fact not shown by these curves is that on the basis of its intensity of visual light, its energy in the near or penetrating infrared (7000-14000 Å) also agrees closely with that found in natural sunlight.

When the carbon contains such metals as iron, the distribution of energy is quite different, as shown in Figure 4. This is the curve for a "C" carbon arc, which contains iron, aluminum and nickel. In this case the intensity in the ultraviolet below 3140 Å is very much higher, while the visual light is greatly reduced. In terms of absolute intensities, a given area under the arc curve indicates only a tenth as much energy as with the same area under the sunshine curve. While it can be said that such a carbon will produce some of the effects of sunlight, such as the curing of rickets and the production of erythema or tan, its effects are in many respects quite different from natural sunlight.

In the past few years a number of papers have been published giving the relative intensities of the different lines in the spectrum of the quartz mercury arc. Measurements of this type have been presented by Benford⁽⁷⁾ in the form of a spectral energy distribution diagram somewhat similar in principle to ours. His results are shown in Figure 5, together with the sunlight curve. In this case a given area under the curve for the arc corresponds to only one-hundredth of the intensity of the same area under the curve for sunshine. This curve resembles that for the "C" carbon arc to the extent that it shows a relatively high percentage of radiation in the short wave ul-

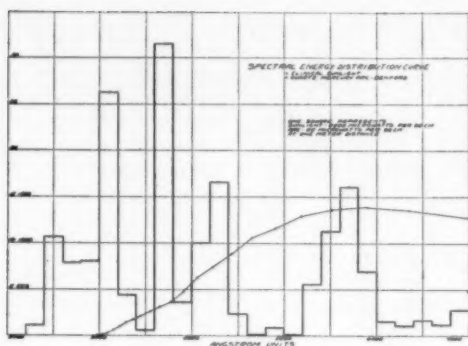


Fig. 5

traviolet not found in sunlight, and a relatively low intensity of visual light.

An illustration of some of the possibilities in modifying the pattern of radiation from the carbon arc is given in Figure 6, showing the effect, first, of cobalt, which increases the intensity in the very short wave ultraviolet 2400-2500 Å.; second, magnesium, which gives a high intensity in the region 2800-2900 Å.; and third, strontium, which gives a low intensity in the ultraviolet but a very high intensity of penetrating red radiation near 6500 Å.

In Figure 7 is shown the energy distribution curve for a plain carbon arc containing no light producing salts. This is the type of light used by Finsen in his pioneer work on artificial heliotherapy. In this case most of the radiation comes from the incandescent carbon tips, rather than from the arc itself as is the case with the "flame" carbons described above.

As a source of ultraviolet the modified or "flame" carbon arc has several inherent advantages. The first is its versatility, whereby

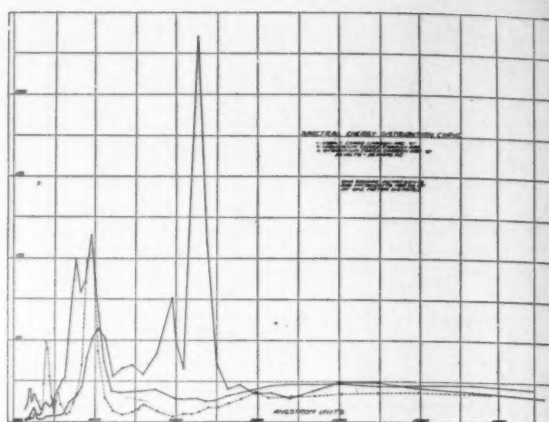


Fig. 6

the type of light can be varied by changing the type of carbon used. The second is the possibility, when desired, of obtaining enormously high intensities of ultraviolet. The third is uniformity of intensity over long periods of time. The second point cited results from the fact that when the current through the arc is increased the ultraviolet intensity increases still more rapidly. Up to about 30 amperes the ultraviolet increases approximately as the square of the current, or doubling the current increases the ultraviolet output about fourfold. Beyond 30 amperes this increase is less rapid, but it is possible even at this point to increase the efficiency of ultraviolet production by increasing current, as is shown in Figure 8. As is shown in Figure 9 for the "C" carbon arc, the principal effect of increasing the current is to increase the total intensity, while the energy distribution curve retains its characteristic shape.

A comparison of the relative intensities of some of these light sources, based on the single criterion of ability to produce erythema, is given in the following table:

TABLE 1—Light Source

	Erythema Intensity (Arcs at One Meter Distance)
Noon Fall Sunlight ("Clinical Sunlight")	1.0
Noon Summer Sunlight	1.7
M-1 Carbon Arc Lamp — Sunshine Carbons, Corex "D" Screen	1.8
30 Amp. Sunshine Carbon Arc — No Reflector or Screen	2.5
30 Amp. "C" Carbon Arc — No Reflector or Screen	15.4
60 Amp. Sunshine Carbon Arc — No Reflector or Screen	12.2
60 Amp. "C" Carbon Arc — No Reflector or Screen	42.5

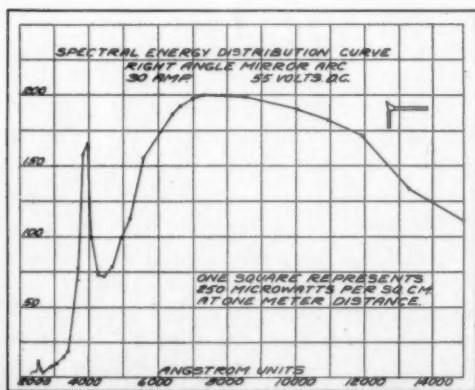


Fig. 7

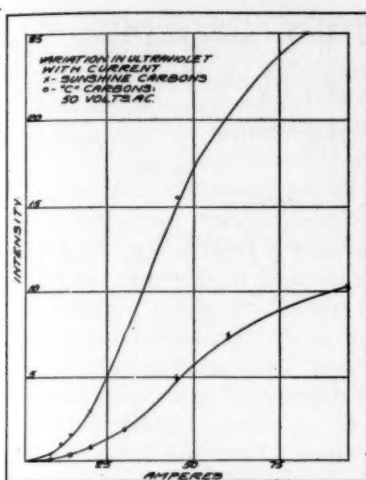


Fig. 8

In order to realize the constancy of intensity which should be attainable, it is necessary that both the voltage and the current at the arc be kept reasonably constant. With some of the older types of lamp this was rather difficult to attain, but there are now available lamps either for use in the physician's office or for larger group irradiation, in which by means of a motor feed mechanism and automatic regulators the voltage and current, and consequently the output of light, is kept constant over any desired period of time. It has been reported from the Bureau of Standards⁽⁶⁾ that with a lamp of this type the ultraviolet intensity with a given type of carbon did not vary by more than 1 per cent either throughout the burning period of a single pair or from one carbon to another.

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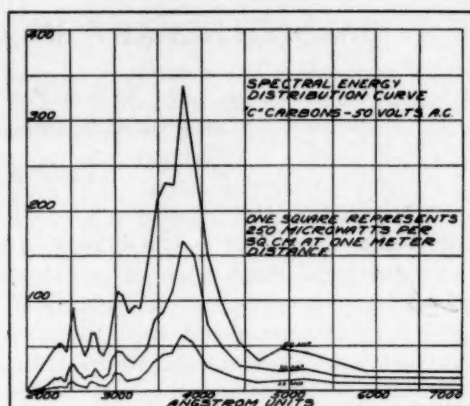


Fig. 9

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BALNEOTHERAPY IN CIRCULATORY DISORDERS *

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Balneology according to Stedman's Medical Dictionary, is that branch of medical science which treats of the constitution of natural mineral waters and their therapeutic employment, especially in the form of baths. In the present discussion, the writer desires to limit his remarks to the application of the naturally carbonated mineral waters in the treatment of cardiac and vascular disorders. The origin of this therapy is generally attributed to Beneke,⁽¹⁾ who in 1859 reported favorable results in some patients treated at Bad Nauheim for rheumatic ailments who also had certain disorders of the heart. He noted clinically that the cardiac disorders improved. These observations led to further studies, which have been continued at Nauheim and carried on at other spa where naturally carbonated saline waters are found.

Physiologic Effects of Carbonated Baths

An understanding of the physiology of the skin, of the circulation, especially the peripheral capillaries, and of the autonomic nervous system, is important in the interpretation of the results obtained from carbonated baths. These results depend on the condition and the reaction of the patient to certain influences of the bath. In evaluating the condition of the patient, one must consider, first the severity of the circulatory disorder present and, second, the mental reaction to the course of treatment. In estimating the influence of the bath, one must consider three major factors, — the thermal, the mechanical, and the chemical effects. The *thermal effects* depend on the temperature of the water. Here the old principle that heat expands and cold contracts comes into play. A warm bath will aid in producing relaxation while one which feels cool may cause stimulation. Between these two extremes is the so-called indifferent point when the bath is felt neither as warm nor cool. With the average individual, this temperature usually falls between 90 and 95 degrees F. for the naturally car-

bonated water. This is 2 to 5 degrees cooler than the neutral temperature of plain water. The *mechanical influences* of the bath depend on the pressure exerted on the outer surface of the body. This pressure increases directly with the amount of saline constituents in the water. These effects are noted in a pressing out of venous blood and lymph from the extremities, increased abdominal pressure and a limitation of the respiratory excursion. The *chemical stimulation* depends on the substances which are present in the bath, of which the saline constituents and the carbon dioxid must be considered. Observers are at present agreed that the carbon dioxid is the most important of these factors in producing the results.

The metabolic observations of Groedel and Wachter⁽²⁾ and the chemical studies of Hediger⁽³⁾ have established the fact that carbon dioxid passes from the water through the skin, into the body. Groedel and Wachter studied the respiratory metabolism of patients before, during, and following a bath in plain and in carbonated water. They observed a marked increase in the elimination of carbon dioxid in the expired air, with only slight variations in the oxygen consumption during and after the carbonated water bath. This increased output of carbon dioxid lasted for one to two hours after the end of the bath and was not present in the plain water bath. Hediger fastened a glass bell jar containing carbonated water to the skin and determined chemically the amount of carbon dioxid in samples of water from this vessel at stated intervals. He found at first a rapid fall of the carbon dioxid and later a more gradual fall. These two experimental studies establish the fact that carbon dioxid passes through the skin from the carbonated water bath. Yet to explain how the carbon dioxid produces its effect on the circulation beyond this point is not possible at the present time. Whether the action is due to chemical influences of the carbon dioxid acting on the capillary wall or

* Read before the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 15, 1933.

to reflex influences through the nervous system, or to both, is not known.

The carbonated mineral water bath produces certain physiological effects on the circulatory system both in healthy subjects and in patients suffering from circulatory disorders. The effects may differ quantitatively, depending largely on the severity of the cardiac condition. A striking response to the bath is a diffuse reddening of the skin under the water. It is not evident in portions of the body which are not submerged. There is a sharp line of demarcation. This reddening or hyperemia indicates a peripheral dilatation of blood vessels with an increased amount of blood near the skin. Generally one observes a decrease in the pulse rate of 5 to 8 beats per minute. If the pulse increases during the bath, it is taken as an indication that the patient is not responding well. An increased minute volume output of the heart has been observed in experimental studies by Bornstein and Budelmann.⁽⁴⁾ A decrease in pulse rate combined with the increased minute volume output results in an increased stroke volume which may be taken as an indication of better cardiac efficiency. In observations with a continuous blood pressure recording apparatus during the bath,⁽⁵⁾ an increased pulse pressure was noted, which was produced more by a decrease of the diastolic than by an increase of the systolic pressure, although both the above changes occurred. In addition, the respiration is distinctly greater in depth and in some patients the rate is slightly decreased.

The natural carbonated mineral water used for the treatments at Saratoga Springs contains approximately one per cent of saline constituents and is supersaturated with carbon dioxide. The constituents are mainly the chlorides of sodium and potassium and bicarbonates of sodium, calcium, magnesium and iron. The water contains approximately 2.5 gm. of carbon dioxide per liter at the source, where the temperature is 50 to 52 degrees F. When prepared for the bath between 90 and 95 degrees it contains from 1.3 to 1.4 gm. per liter. At the end of a bath of fifteen minutes, it contains approximately 1.2 gm. per liter.

Variable Factors in Balneotherapy

In using the water for balneotherapy, there are certain controllable factors which may be varied to produce different effects in the course of treatment. Usually the temperature

is kept near the indifferent point of 92 to 95 degrees F. at the start and toward the end it may be lowered to 88 degrees or in some instances even 2 to 3 degrees lower. The duration is generally from 8 to 15 minutes, starting with the shorter period in the bath and gradually increasing the time to a longer interval. The amount of gas may be reduced if the patient will not tolerate the full amount. Patients with myocardial weakness from any cause and those with general arteriosclerosis are usually started with approximately one-half the effective supersaturation of carbon dioxide and as the series progresses, the amount of gas is gradually increased. For patients who have difficulty in breathing when lying down, the position in the tub may be semi-sitting with the shoulders and upper portion of the chest kept out of the water in order to avoid mechanical pressure on the chest. The frequency of the baths depends on the condition of the patient and they are usually given four or five times a week for a period of about four weeks. An experienced attendant prepares the bath according to prescription, observes the pulse, and reports the reaction of the patient. In general, a rest period of one-half to one hour follows the bath. In addition, many patients are directed to return to their room and rest there for another hour.

These variable factors may be altered to fit each individual. The cardiac patient should be carefully observed by his physician during the course of treatment in order to make changes in the program from day to day, if necessary.

Effect of Treatment

As a result of the course of treatment outlined above, there is usually a slight decrease of pulse rate. In 88 patients who were studied during the past season for changes in pulse rate and blood pressure, no marked change occurred as 60 per cent of the group did not vary more than 5 beats per minute when the resting pulse at the end of the series of baths was compared with that at the beginning. Approximately 30 per cent showed a definite reduction of 6 to 20 beats per minute; 90 per cent of the patients had pulse rates between 65 and 80 per minute at the start so no striking change could be expected. An average of the differences between the pulse rates taken before and after the daily bath showed that in

98 per cent of the patients a reduction in the rate occurred.

Regulation of blood pressure, either high or low, with a return toward the normal level will frequently take place. In patients with a lowered pressure due either to myocardial weakness or to nervous exhaustion, moderate increases are found. In idiopathic hypotension, little change has been observed. In 52 patients of the group mentioned above whose systolic pressure was over 150 mm. Hg. at the start, 27 showed a reduction of more than 10 mm.Hg. with a maximum drop of 42 mm.Hg., 19 patients showed a change of less than 10 mm.Hg. and 6 showed slight increase of the pressure. No general conclusion can be drawn from this small series, but a definite reduction was observed in approximately one-half of the group.

Roentgenograms taken before and after a course of baths show in some patients a definite reduction in the size of the heart shadow. The electrocardiogram may reveal a change from abnormal to normal rhythm, a turning of an inverted T-wave to the upright position, and the disappearance of heart block in a rare case. Relief from anginal pain which may last in some cases for a period of months following the course of treatments has been noted. Improved function, as judged by an increased vital capacity, improved exercise tolerance and decrease of dyspnea and cyanosis follow a course of treatment.

The results obtained give evidence that there is a definite indication for a course of carbonated baths in patients with moderate myocardial weakness, convalescence from rheumatic endocarditis, angina pectoris, arteriosclerosis, coronary thrombosis (six to twelve months after the acute attack), varia-

tions in blood pressure, and neuroses with circulatory symptoms. The contraindications for a course of treatment include acute or severe decompensation, advanced syphilitic heart disease, severe paroxysmal dyspnea, and acute endocarditis with fever.

Conclusion

In conclusion, one must stress the very great value of regular living during the course of treatment, including regular meals, regular rest periods, regular exercise, and relaxation, both mental and physical, due to being away from one's work amid pleasant surroundings with good music. Attention must also be given to good elimination, regulation of weight by dietary control, and the avoidance of alcohol and tobacco in excess. All of these factors must be considered in any well rounded program. Balneotherapy, properly prescribed and administered, is taking its place with the standard methods of treatment of circulatory disorders.

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Attend Post-Graduate Seminar
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E D I T O R I A L S

UNDERGRADUATE INSTRUCTION IN PHYSICAL THERAPY

Just as hope is often father to the act, so it may be predicted that the increasing consciousness of the profession towards things physical therapeutic will come into full appreciation when the undergraduate student will be offered similar opportunities to orient himself in this field as he is in other branches of practice. The teaching of physical therapy to undergraduate students has been critically discussed in previous issues of the ARCHIVES⁽¹⁾, (2), (3), (4), (5), (6), (7), and its problems expatiated at some length. That it is a problem of strategical importance in modern therapy is indicated by the cogent article recently published in the *Journal of the American Medical Association*⁽⁸⁾, the most recent of a series of reports gotten out under the constructive direction of its Council on Physical Therapy. It goes without saying that the conservative but nevertheless progressive attitude of this body in its evaluation of the entire discipline of physical therapy has been so uniformly brilliant as to justify the growing confidence of organized medicine in its published opinions.

At this moment it is beside the point to argue that much of the existing misunderstanding and suspicion in the rank and file

of organized medicine are due to the "picture of a room filled with a large assortment of brassy, shiny, complicated electrical machines and lights," or to the existence of a feeling of repulsion against a therapy which requires the application of manual procedures — massage, corrective exercise, or such simplified remedies as regulated baths and radiant light bakers. No one at this moment questions the utility of x-ray therapy because of the elaborate and expensive machinery utilized in its practice. The mystery and the costliness of radium has not deterred a conservative profession from its use. No apparatus is costly when it clinically is able to fulfill the promises inherent in its scientific application. In the majority of instances the limitations are often to be found in the individual's education regarding the use of the instrument in his possession. And here one again is prompted to repeat the platitude attributed to the late Elbert Hubbard; namely, that "people are often down on things they are not up on." This is a defensive reaction, rather than a rational explanation of the facts as they exist.

The reason for the growing consciousness toward physical therapy must therefore be sought elsewhere, but the remedy — teaching of physical therapy to undergraduate students — is practical, logical, timely, and contains promise of great good. Its casual relation-

ship to the recent World War is so well known that it needs but mention to be fully appreciated. The reclamation of the shattered forces in all lands was the greatest single objective of the post war period and found its greatest remedy in the physical agencies since then rediscovered and developed. But what is not apparent to most of us is the new consciousness that has developed since the close of the gigantic military struggle. It cannot escape the observing eye that at this very moment unfolds itself incontestible evidence of a renaissance in the discipline of medicine and especially in physical therapy. This in part explains the present attitude taken by Lewinsky-Corwin⁽⁸⁾, who says:

The problem of chronic disease is an important social problem which the medical profession will some day be forced to realize and meet in an adequate manner. There is no doubt that the failure on the part of the medical profession at large to employ all the means at its disposal to deal with chronic disease has been responsible for the growth of cults. The relief which many patients receive from the administration of the various kinds of physical and psychic therapy practiced by the exponents of these cults has resulted in the development of spurious practices which often are as injuries to the individual and inimical to the public health as they are lucrative.

Contrasted with the above we read in Cutter and Coulter's⁽⁸⁾ special article the utterance of a distinguished clinician who said:

There are two main reasons why, in the treatment of cardiovascular disease, physical therapy has been practically ignored in this country:

First, that from lack of training or interest or both, the average American physician knows little of the types of physical therapy, that may help cardiovascular patients and still less concerning the effective, detailed manner of applying treatment. Lack of interest usually accompanies lack of knowledge concerning a given subject.

Second, that following the usual rule of supply and demand, since there has been no demand for thermal stations, spas or establishments in which physical therapy is properly given in this country, relatively few such establishments are available.

Enough has been shown in the above statements to justify the contention that we are at present confronted by the dawn of an era characterized by independent and higher evaluations that point towards a new orientation in physical therapy.

It is beyond human power to change the past, although this is not to be interpreted as a complete negation of its positive values, for it is evident that its influence is more or

less directly responsible for a concept which promises a better and more fruitful future. A realization of this will, however, be brought about only through the systematic training of the undergraduate generation to enable it successfully to avail itself of the therapeutic benefits with which physical therapy is so richly endowed. But even with a more or less general adoption of such training in American medical schools the problems will not be effectively solved unless the student is taught in his formative period the rightful relation of physical methods to pharmacal and other forms of standardized therapy.

It is properly pointed out in the special article under consideration that in the undergraduate training physical therapy must be approached not as a specialty but as a part of general medicine. Furthermore, physical therapy must not be isolated as a fragment but correlated as an interdependent link in the complete chain of therapeutic instruction. Such a rôle assigned to physical therapy in general medicine is sure to receive the full hearted support of every progressive physician who has given thought to the vexing problems effecting the future of scientific medicine.

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SCIENCE, NEWS, COMMENTS

British Anti-Cancer Serum Aids Human Patients

"Encouraging results" in the treatment of 25 human cases of cancer with an anti-cancer serum were reported by Dr. Thomas Lumsden of the London Hospital at the annual meeting of the British Empire Cancer Campaign.

Twenty-five victims of this dread disease volunteered to undergo the serum treatment which Dr. Lumsden has been working on for more than seven years. They were suffering from cancers which had recurred after the original tumors had been treated by surgery or radium. Their condition was diagnosed as hopeless by physicians.

Each of these volunteers had some of the serum injected into the main mass of his cancer or into the artery leading to it. Dr. Lumsden reported that the results in these cases were so encouraging as to justify "intensive pursuit of the method," although he considers the work still in the experimental stage.

The chief difficulties with the treatment are achieving distribution of the serum throughout the tumor and keeping it localized in the tumor area long enough for it to produce results.

In these human cases, Dr. Lumsden used only one fraction of the anti-serum which he has been developing. This fraction, called the euglobulin fraction, gives a solution of anticancer bodies ten times as strong as the anti-serum as a whole. In other words, it is ten times as potent a weapon for treating the disease.

The serum not only cured spontaneous cancers in mice but prevented the recurrence of such cancers in seventy-five per cent of the animals. Some of these mice are now living a year after the injection of the anti-serum. The fact that one year of life for mice corresponds roughly to thirty years of life for man gives an idea of the effectiveness of this method of treatment. Five years of freedom from the disease is considered the criterion for cure of cancer in man. — *Science News Letter*.

Stomach Ulcers May Result From Lack of Vitamin A

Evidence that stomach ulcers may result from diets lacking in vitamin A was presented to the American Society for Experimental Pathology by Dr. Ira A. Manville of the University of Oregon Medical School.

Dr. Manville reported that white rats fed a diet deficient in vitamin A developed stomach ulcers and erosions. Nearly two-thirds of all the animals fed on diets that were deficient to various degrees in the vitamin showed these sores. As the vitamin deficiency became more severe, the number of animals affected became greater until nearly 100 per cent were found to have ulcers.

Vitamin A, found in liver, butter, egg yolk, cheese,

cod liver oil, spinach and the leaves of plants, is necessary to promote normal growth. In its absence growth is stunted and a severe eye disease develops. This vitamin is also considered necessary for normal functioning of the mucous membrane of nose, throat and breathing apparatus, and urinary and gastrointestinal tracts. In this connection it has been claimed that vitamin A prevents colds.

It is in its effect on the mucous membrane of the stomach that Dr. Manville believes vitamin A is concerned in the formation of stomach ulcers. According to modern theory, stomach ulcers are formed when the acid normally present in the stomach is able to penetrate the lining of the stomach and so eat away part of the stomach wall. It is considered not so much a question of too much acid in the stomach as of a lessening or absence of factors that normally neutralize the acid.

In Dr. Manville's opinion, the mucous lining of the stomach acts as a protective device against the acid's action. Since vitamin A is necessary for the well-being of this mucous lining, he reasoned that ulcers might develop when the vitamin was lacking in the diet. Investigations with animals fed on diets that had little or no vitamin A seem to have borne out his theory. — *Science News Letter*.

Optimism Best Aid Against Rheumatoid Arthritis

A cheerful optimistic temperament is a great asset for the patient fighting rheumatoid arthritis, Dr. Russell L. Cecil of New York City said in a discussion of the prognosis in chronic arthritis before the American Clinical and Climatological Association.

The prospects of recovery from chronic arthritis, sometimes popularly known as rheumatism, depend primarily on the type of arthritis from which the patient is suffering, Dr. Cecil stated.

In the case of osteoarthritis, the characteristic degenerative changes are permanent and tend to progress slowly. The symptoms resulting from these changes, however, can usually be ameliorated or entirely cleared up by proper treatment.

"The disease never menaces life," Dr. Cecil stated, "but the danger of serious deformity and crippling always exists, especially in neglected cases."

It is in this type of arthritis that the cheerful, optimistic temperament was said to be a great asset. Young people respond to treatment better than elderly patients. Those who have an acute onset seem to have a better chance than those whose symptoms come on insidiously. Much depends on the joints involved, the knees, the hips and back offering the greatest difficulty.

Finally, the ability and the disposition of the patient to devote himself zealously to the regime and treatment prescribed by his physician is of the greatest importance in forecasting the chances of recovery.

Scientists Unleash Largest Atom-Attacking Machine

Seven million volts, man's closest approach to the voltage of nature's lightning, flashed across the gigantic ball terminals of science's greatest generator, erected by Massachusetts Institute of Technology physicists in Col. E. H. R. Green's airship hangar at Round Hill, Mass., and operated Tuesday for the first time at so great an electric potential.

Sparks forty feet long were sent arcing between the two huge metal spheres of the generator. Though the seven million volts achieved is three times the highest direct current potential heretofore attained, it is less than the generator's full designed voltage by three million volts. A full voltage test was not attempted because high wind prevented taking the machine into the open, but the designer feels confident that ten million volts will be produced on the first outdoor attempt.

This is the opening report in an investigation of some of the most important and fundamental of nature's secrets and it may have far reaching consequences in even the commercial generation of electric power.

A few years ago there was a young Rhodes scholar at that old English university, Oxford. Puzzling upon the problem of power for smashing the atom and studying its internal structure, Dr. Robert J. Van de Graaff went back to the idea of the old-fashioned static generator for electricity, the sort of electrical machine used by Ben Franklin, pioneer American scientist.

Modern electrical generation had developed along the line of electro-magnetism and Dr. Van de Graaff revived the other principle and built it into a modern machine. He went to Princeton University as a National Research Fellow, and built a small laboratory model of his generator at the cost of a few hundred dollars. It produced between 1,000,000 and 1,500,000 volts, the highest direct voltage current ever attained up to that time. Much more expensive apparatus, upon which other scientists had worked for years had been able to produce only 800,000 volts direct current.

Working with Dr. Karl T. Compton, then professor of physics at Princeton, Dr. Van de Graaff joined the M. I. T. staff when Dr. Compton became president of that school.

With the aid of associates, they visualized a giant generator, the electricity producing machine that in its tests has fulfilled their expectations.

No conventional building at the Massachusetts Institute of Technology was large enough to house the large Van de Graaff generator. Col. Green offered his airship dock on his estate at Round Hill, Mass., a structure 140 feet long, 75 feet wide and 75 feet high, with railroad track running into it and doors that weigh over 23 tons.

The 10,000,000 volt Van de Graaff generator consists of two large hollow columns, 25 feet high and six feet in diameter, which are surrounded by a heavy polished aluminum sphere 15 feet in diameter. Each column is mounted on a heavy four-wheeled truck running on a railway track 14 feet wide. The spheres, which act as reservoirs into which electricity is poured by relatively small static genera-

tors at the base of the columns, rise to 43 feet above the ground.

Even while the generator is running at full potential, scientists can stay and work within the 15 foot diameter aluminum spheres, surrounded by high potential electric fields.

The giant aluminum spherical terminals are unique in construction, the largest such structures of this metal ever produced. They were made by fabricating orange-peel sections which were welded and then polished to a bright finish so as to eliminate projections that would cause the electricity to spark away. Although built of light metal a half inch thick, each hollow ball weighs a ton and a half.

The spheres are charged with electricity by a process not unlike the old-fashioned method of raising water from a well by means of small buckets on an endless chain, each bucket dumping its load as it turns over a pulley at the top. Paper belts, four feet wide, convey upward the electrical charges sprayed upon them at the base at the comparatively low pressure of 20,000 volts. Or the giant generator can actually be operated without any artificial source of electricity, as it can draw the necessary electrical charges from the earth.

When the real work of the Van de Graaff generator begins, there will be no spectacular electrical fireworks. A large vacuum tube, a foot in diameter and 40 feet long, designed by Dr. L. C. Van Atta, made not of glass as is usual but of laminated paper, will extend from one sphere to the other and the electricity will discharge through it, creating the most powerful x-rays ever known by hurling millions of electrical "bullets" against a metal target. Each of these "bullets" will be moving at velocities 100,000 times greater than the speed of any rifle bullet. — *Science News Letter*.

X-Rays Render Water Poisonous to Protozoa

X-rays played upon water or nutrient fluids make them deadly to protozoa by producing very small quantities of hydrogen peroxide. Experiments in which this fact was discovered are reported in *Physiological Zoology* by three Stanford University zoologists, Dr. C. V. Taylor, J. O. Thomas and M. G. Brown.

Experimenters first discovered that if they x-rayed a nutrient solution and then put in the species of protozoon they were using, *Colpidium campylum*, the animals died, despite the fact that the deadly rays never touched them. They found the same fate following their protozoa in x-rayed water.

They tested both the culture fluid and the water with titanium chloride, a compound extremely sensitive to the presence of hydrogen peroxide. The test indicated hydrogen peroxide in very small quantities—on the order of one part in a hundred thousand of water. The addition of one part of hydrogen peroxide to 450,000 parts of water rendered it toxic to the protozoa.

Then they tried the effect of x-rays on highly purified water from which all possible traces of dissolved oxygen had been removed. This water

did not prove toxic to the protozoa. Water to which organic colloids, like sheep blood or agar, had been added was not rendered toxic by x-rays.

Recognizing that x-rays may also produce other toxic substances, the experimenters nevertheless regard the production of hydrogen peroxide by x-ray action as of considerable significance in the known deadliness of x-rays to protozoa and other types of cells. — *Science News Letter*.

Brain Gland Secretion Found Cause of "Pop-Eye" Goiter

A new hormone of the pituitary gland that exercises control over the thyroid and seems to "double" for the secretion of that gland producing exophthalmic goiter was a leading topic of discussion among medical scientists at the meeting of the Federation of American Societies for Experimental Biology.

As one doctor expressed it: "The pituitary gland is in the driver's seat."

It is small but important, located at the base of the brain. It produces many powerful hormones or chemical regulators of the body's activities. Some of these hormones have an important stimulating effect on the sex glands. Another hormone promotes growth.

The latest discovery is a new hormone that influences the secretion of thyroid gland. Exophthalmic goiter, characterized by extreme nervousness and protruding eyes, results from over-secretion of the thyroid gland. Now scientists have found the newly discovered pituitary hormone can produce the same effect.

For the first time scientists have been able to produce this type of goiter in animals, which will greatly aid further research on this serious and widespread disease for which the only relief at present is surgical operation.

Daring French scientists have reported that they produced exophthalmic goiter in human beings by doses of the latest pituitary hormone.

The first announcements of the new hormone received little recognition even from scientists.

But now the full significance of the new hormone is apparent and in many research centers studies are being made upon it.

Whether or not future treatment of exophthalmic goiter will be directed toward the pituitary instead of the thyroid gland cannot be determined from these early investigations. — *Science News Letter*.

Paprika Acid, Probably Vitamin C, Cures Scurvy

An acid prepared from paprika cured a man of scurvy when injected into his veins, it appears from a report by Dr. Paul Schultzer, resident physician of the Copenhagen Municipal Hospital, to *The Lancet*.

The acid is ascorbic acid. It was formerly known as hexuronic acid and is generally thought to be identical with vitamin C. This is probably the first time it has been used to cure the disease, which results from lack of vitamin C.

The acid was isolated from plants and from the adrenal gland cortex by Szent-Gyorgyi. He and other investigators in Europe and America have reported its scurvy-preventing power in animals.

Dr. Schultzer's patient was a married man 68 years old, a former blacksmith who had been living for some time on a diet which was lacking in scurvy-preventing vitamin C. He never took milk or any dishes prepared with milk and never ate any potatoes, vegetables or fruit. The man came to the hospital with typical symptoms of scurvy, which grew worse when he was kept on a diet known to be deficient in vitamin C.

Injections of ascorbic acid, prepared from the paprika plant by Szent-Gyorgyi resulted in rapid recovery. — *Science News Letter*.

Tumor of Pancreas Believed Cause of Much Mental Illness

Many sufferers from mental disorders might be restored to their right minds by surgical operations removing tumors of the pancreas, a report of the American Association for the Advancement of Science reveals.

These patients have a disease that is practically the opposite of diabetes, Dr. Evarts A. Graham of Washington University of Medicine, St. Louis, declared. They suffer from a lack of sugar caused by the presence of too much insulin, which rapidly uses up the sugar of the body, Dr. Graham explained. He pointed out that certain tumors of the pancreas have been found to be responsible for stimulating the secretion of insulin to over-production.

Convulsions, often mistaken for epilepsy, and mental confusion resembling that of alcoholic intoxication result from this lack of sugar, Dr. Graham said; consequently, many persons who have this condition consult a neurologist first.

"One is forced to wonder," he continued, "how many patients there are in our mental institutions suffering supposedly from epilepsy and other mental disorders who perhaps really have pancreatic tumors of this type which could be removed with a satisfactory disappearance of the symptoms. This condition is undoubtedly much more common than the few reported cases would indicate."

"Sometimes these tumors of the pancreas are cancers," the surgeon explained, "but many of them are benign (adenomas) which after removal do not return. It is interesting that seven cases have been reported in which a tumor of this tissue has been diagnosed and removed successfully. Three of these patients have been operated on at the Barnes Hospital, St. Louis. One of our own cases is unique in the fact that after the removal of one tumor it was necessary to perform a second operation a few weeks later to remove a second tumor. In all of these instances the patient has made a successful recovery from his symptoms."

The tumors originate in tissue which forms the so-called islets of Langerhans of the pancreas. This is the tissue which produces insulin, the substance that patients suffering from diabetes lack. — *Science News Letter*.

Wax Model Helps Fix Dosage of Radium

Measuring the intensity of radium applied externally for treating cancer in the head or neck is a problem that one British hospital has attempted to solve by use of wax models.

A life-size human head has been built up in a series of sections about one-third of an inch thick. Each is cast in wax of very nearly the same density as the soft tissues, and superimposed on the top and bottom surface of each section is a photograph of the anatomical structures occurring there. If the actual radium applicator used on the patient is applied to the model it will affect a photographic film inserted at any particular level where the dosage is in question so that after development its relative intensity can be measured.

In the report summarizing the results of research work in the treatment of cancer by means of radium lent to selected centers in Great Britain where this is mentioned, the Medical Research Council states that although new lines of technic are being explored it cannot be said that any one method has yet been devised and tested which gives the fullest scope to radiological methods.

Heart Stimulant Effective As Cyanide Antidote

Amyl nitrite, well-known heart stimulant, is a better antidote in cyanide poisoning than the dye, methylene blue, it appears from experiments reported to The Journal of the American Medical Association by Drs. K. K. Chen and G. H. A. Clowes and Charles L. Rose of Indianapolis.

These experiments indicate that amyl nitrite is at least twice as efficient an antidote to cyanide as the blue dye. It is also more easily given, since it may be administered by inhalation while the dye must be injected by hypodermic.

The blue dye has recently been used with success in treating cases of both cyanide and carbon monoxide poisoning and has become the subject of considerable scientific discussion.

(Continued from page 355)

used in England, in France, and in our own army, but up to date it has not won the place it probably deserves as a special method for treating painful inflammatory diseases of either extremity. This treatment is thoroughly described by F. Howard Humphris of London, and also by H. E. Stewart of New Haven in their books on physiotherapy. Humphris says that the most satisfactory wax to use is highly refined British wax called Sternal Ozonized Thermal Wax, because it is thoroughly impregnated with a powerful antiseptic, which also gives it a refreshing odor. He believes that the wax should be thrown away after each patient, not because it becomes infected, but because the fatty elements of the sweat float up and mix with the wax, altering its composition.

The whole explanation for the fact that the skin will tolerate a temperature of 130 to 140

The Indianapolis scientists started their investigations on amyl nitrite following reports of Dr. E. Hug and Dr. W. B. Wendel. The former showed that sodium nitrite was a better antidote for cyanide than methylene blue, and both Dr. Hug and Dr. Wendel, working independently, came to the conclusion that methylene blue neutralizes the effect of the poison by forming the compound, cyanmethemoglobin. — *Science News Letter*.

Oreston Suggested as Name for New Positive Electron

A name is wanted for the newest particle discovered by science, the positive electron. "Positron" has been suggested and is widely accepted. But many scientists object to it, on the grounds that it lacks proper character. Prof. Niels Bohr in his talks to the California Institute of Technology, where the positive electron was discovered, pointed out the desirability of a new name and mentioned "anti-electron" as a possibility but did not urge it. He said it had the advantage that it suggested the fact that the positive electron is, in a sense, merely the absence of the negative electron.

The most brilliant suggestion, however, has come from Prof. Herbert Dingle, visiting here in Pasadena from the Imperial College of Science and Technology in South Kensington. He recalled the fact that Electra had a brother Orestes and surely the positive and negative electrons are like brother and sister. He therefore suggested the name "Oreston" for the positive electron.

The appropriateness of this suggestion becomes especially apparent when one realizes that the oreston as observed in physics, does not have a long life but very soon combines with an ordinary electron. The two annihilate each other. As they disappear, their energy is given out in the form of light quanta. — *Science News Letter*.

degrees F. in the case of paraffin, whereas it will only tolerate a temperature of 104 to 105 degrees F. in the case of water, is not quite clear. The following facts, however, are probably important factors:

1. Paraffin wax, in the state of oil which it assumes when heated, is a much feebler conductor of heat than water.

2. The temperature of the skin is normally 92 degrees F. As soon as an arm or a leg is inserted into a paraffin bath, a thin layer of wax immediately congeals on the skin, and this prohibits the skin from any direct or prolonged effects of the heat. This layer of paraffin can always be increased by removing the arm or leg for a few minutes from the bath. We are all indebted to Dr. Wyatt for calling our attention to the fact that, in this country, we have not sufficiently utilized this valuable and practical form of treatment.

THE STUDENT'S LIBRARY

PATHOLOGIE UND KLINIK DER GRANULOSA ZELLTUMOREN (Pathology and Clinic of Granulosa Cell Tumors). By *Dr. Walter Schiller*, Assistant at the II University Gynecologic Clinic of Vienna. Cloth. Pp. 197. With 129 illustrations, 3 multicolored plates, and 2 tables. Price, 16 marks. Vienna: Wilhelm Maudrich. (American Agency: Chicago Medical Book Co., Chicago). 1934.

The question whether granulosa cell tumors of the ovary are benign or malignant has been the subject of dispute between pathologists as well as gynecologists without arrival at a definite conclusion. It is clear that all surgeons, general as well as gynecologic, would feel more solid ground were the important problem of a possible malignancy of this type of ovarian tumors definitely settled. One need only think of the harm that must come to young women when they are ordered to take a postoperative course of x-ray applications, once the surgeon has extirpated a granulosa cell tumor, to realize the importance of the question of benignity.

The present volume should, therefore, be welcomed as a very important addition to the literature for a number of reasons. In the first place the author has made not only a number of clinical observations but has undertaken much careful research, the details of which must be studied in the original, because they do not lend themselves to a brief review. In the second place the conclusions reached by Dr. Schiller are encouraging in that he declares the large majority of these ovarian tumors to be benign, so much so that he regards those of the malignant types to be really carcinoma. The colored histologic illustrations are exquisite, appearing as clear as one sees stained tissues under the microscope. The other (black) illustrations are photographs, which leave little to be desired for clearness. The text proper is lucid, free from padding, and severely scientific in tone and content. It is a book which should by all means see an early translation in English.

PHYSIOLOGICAL HEALTH. SCHOOL OF EDUCATION SERIES, NEW YORK UNIVERSITY. Edited by *Jay B. Nash*, Chairman, Department of Physical Education. Cloth. Pp. 308. Price, \$2.00, New York: A. S. Barnes & Co., Inc., 1933.

In this volume health is considered in its physiological sense as the ability of the body to sustain adaptive effort. The basic elements of health and their relationship to physical education are presented in this, the fourth volume of a series on "Interpretation of Physical Education." It is shown that a balanced physical education program is a major contribution in the field of health, and that the basic elements in physical education are (1) building of organic power, (2) removal of drains, (3) removal of strains, (4) training in proper health

habits. The relationship of these elements to health has been emphasized in a convincing manner. Part I defines health, and Part II considers the forces and factors in building health. Dr. Shailer U. Lawton has contributed a chapter on "Philosophical Relationships of Forces Such as Heredity, Activity and Environment." Dr. Dill has written on "A Measure of Health — The Capacity of an Individual for Work." Dr. George Crile has contributed a chapter on "The Physical Nature of Mental Processes." Part III considers health as a basic potential. In this section Dr. McFarland has written on "The Interdependence of Health and Personality Adjustment," and Dr. McCurdy on "Physiological Health and Neuro-muscular Development." Part IV contains, among other chapters, one by Dr. Pickett on "Health as a Basis for Leisure."

It is certain that those practicing physical therapy will be interested in this book, because when using physical therapy it is often a problem of teaching health education. This book should be read by everyone interested in the use of physical agents in preventive medicine.

CHEMISTRY OF FOOD AND NUTRITION. By *Henry C. Sherman*, Ph.D., Sc.D. Mitchell Professor of Chemistry, Columbia University. Fourth Edition. Cloth. Pp. 614. Price, \$3.00. New York: The Macmillan Co., 1932.

Seven years ago appeared the last edition of this noteworthy and authoritative work, which was acclaimed by all students of nutritional problems as one of the best, if not the best exposition of all problems in the field indicated by the title of the book. After an interval of five years the medical and allied professions are in the fortunate position of being given the same book, which differs so largely from the former editions that one can safely say that we have an entirely new work with which to deal. The author has, as a matter of fact, not only enlarged the subject-matter but has brought the entire science of dietetics and nutrition down to date.

The chemistry of foodstuffs unfortunately has been sidestepped or studied only superficially by the medical profession as a whole. Yet a knowledge of metabolism is incomplete and scarcely more than empiric without at least a fundamental knowledge of the chemistry of the foodstuffs which we use in health and prescribe in disease. In this book the earnest seeker after knowledge has but to follow the text with care to secure all the scientific knowledge needed for the evaluation of foodstuffs and their rôle in nutrition. Thus, to illustrate, the author takes up the subjects of carbohydrates, fats and lipoids, the proteins and their amino acids, the enzymes and digestion, minerals in nutrition, the vitamins as a basic study which does not lose sight of the ultimate use of the knowledge at the bed-

side. The final chapters, of which there are twenty-four, are of especial clinical interest, since they discuss with thoroughness and clarity the chemical aspects of growth and bodily development, dietary standards, and the problem of the best use of food. Much valuable information is tabulated for reference in an appendix. An excellent bibliography and a well prepared index enhance the literary value of the book. Mechanically, too, the publishers have put the valuable contents in good clothing. We urge all readers interested in the problems of diet and nutrition to secure and study this instructive and authoritative monograph.

THE NEW CONCEPTIONS OF MATTER. By C. G. Darwin, M.A., F.R.S. Tait Professor of Natural Philosophy in the University of Edinburgh. Cloth. Pp. 224. New York: The MacMillan Co., 1931.

The conviction has long been accepted as a fact that the foundation of our discipline is inextricably bound up with the basic facts of physics. If this be true, then any authoritative discussion related to matter and its component parts is of more than passing interest. This volume is the collected lectures delivered at the Lowell Institute of Boston and is presented in a popular manner to reach that larger class of individuals appreciative of the changing state through which the speculation and theory of matter is now subjected. Written by an outstanding authority and delivered in non-mathematical style, these lectures will no doubt reach that wider audience of non-specialist readers and convey to them the information usually restricted to specialistic students of the subject. In the space of eight chapters and an index the author presents an advanced concept of matter, permitting the reader to obtain the latest viewpoint regarding atoms, electrons, etc., the nature of waves, their action, propagation, and their velocity in relation to x-rays and to crystals. It follows that this informal discussion must and does include a comprehensive evaluation of the nature, action, and position of the atom in the scheme of the modern conception of matter, for the purpose of providing a logical and scientific background for the subject under consideration. The author possesses a pleasing style which carries the reader over many technical hurdles to a safe comprehension of the new conceptions of matter.

HISTOPATHOLOGY OF THE PERIPHERAL AND CENTRAL NERVOUS SYSTEMS. By George B. Hassin, M.D., Professor of Neurology, University of Illinois College of Medicine; Attending Neurologist, Cook County Hospital, Chicago. Cloth. Pp. 491 with 229 illustrations. Price, \$6.00. Baltimore: William Wood & Company, 1933.

The inadequate space devoted to neuropathology in clinical texts of neuropsychiatry was the motivating incentive for the present work. The author is undoubtedly well justified in his position that for a better understanding of clinical phenomena a more detailed discussion of neuropathology is essential. The material incorporated in this volume is the result of at least two decades of study in the histopathology of the nervous system. The subject matter is divided into four parts and these into 29 chapters, dealing in consecutive order with disturbances of (1) the peripheral nerves, (2) the spinal cord, (3) the brain, and (4) methods of staining, insofar as the structures may be affected by traumatic, degenerative, inflammatory and neoplastic conditions. An unusual amount of detail is here introduced and this in such a concise and cogent style as to fill the gaps encountered in general texts on the subject. Indeed, the author possesses that special enthusiasm of the scientist for his subject the reading of which is certain to reflect an awakened interest by his readers. As an example of bringing his material down to date it is to be noted that the pathologic effect of hyperthermia has been considered and the changes noted. In the light of the growing popularity of heat modalities in an ever-increasing number of conditions this discussion is timely as well as practical. Although this work is specialistic in character, it will nevertheless be found of practical value to the general physician, because it has been presented in such a clear fashion as to permit the "uninitiated" to obtain the much needed interpretation of a large variety of conditions seen first by him and then referred to the neuropsychiatrist. This book is therefore a distinct contribution and of value to both special and general practitioners. It is richly illustrated and contains a wealth of reference for those who wish to even further expand their knowledge on the subject.

INTERNATIONAL ABSTRACTS

Influence of Grenz Rays on Pathogenic Fungi in Skin Material. Emanuel Muskatblit, and Boris Ouspensky.

Arch. Dermat. and Syph., 27:953 (June) 1933.

Grenz rays are now widely used in the treatment of many dermatoses, including fungous diseases of the skin, for which the results obtained are usually even better than with x-rays. Since Grenz rays are absorbed almost entirely by the superficial layer of the skin, just where fungi are found, it is logical to expect that such a type of radiation will influence fungous to a greater extent than more penetrative x-rays. Our experience in the clinic during the last four years (more than two hundred cases of tinea corporis and dermatophytosis) showed good clinical results in the majority of the cases in which Grenz rays were used.

Experimental studies showed that the effect on hairs containing pathogenic fungi taken from children with tinea capitis, exposed to the Grenz rays, in which the viability of fungi was tested by planting those hairs on a culture medium was an indirect one. Grenz rays in doses up to 50,000 roentgens, about seventy times larger than the average single dose used in the treatment of fungous diseases of the skin, did not influence the growth of *Microsporon audouini*, *Microsporon lanosum*, *Trichophyton crateriforme* and *Achorion schonleinii*. The fungus *Trichophyton violaceum* was not affected by 30,000 roentgens. The dose of 50,000 roentgens completely inhibited its growth in two experiments and temporarily delayed it in the third one. Fungous cultures which grew from the hairs irradiated by Grenz rays did not show any peculiarities in their gross or microscopic morphology. The authors therefore conclude that pathogenic fungi in skin material are extremely resistant to Grenz rays even in very large doses. This resistance may differ in different species. Thus *Trichophyton violaceum* proved more sensitive to large doses of rays than some other species. The therapeutic effect of Grenz rays in fungous diseases of the skin is apparently due to the changed properties and reaction of the skin rather than to direct inhibitive influence of the rays on fungi themselves.

Biological Action of Radiant Light and Its Use in Medicine. L. A. Turley.

J. Okla. S. M. A., 26:406, (Nov.) 1933.

By radiant light, the author refers without distinction to x-ray and radium emanation. In his summary he states that there is no question that radiant light is a very valuable therapeutic agent, both for its killing and its stimulating effects. But it should not be used until the exact nature of the tumor or lesion is known, and it should never be

used except by skillful, carefully trained operators. Excessive and insufficient radiation are each useless or dangerous. It is a valuable aid in the treatment of cancer but is not a sure cure for any tumor and is valueless in some types of tumor and some instances of any type. It is the only treatment of any value yet found in certain blood diseases. It is to be hoped that future studies will solve the problem still in doubt so that radiant light will give to suffering humanity the valuable blessings it holds in store.

Medical Aspects of Conditioned Air. Albert H. Rowe.

M. J. and Rec., 138:345, (Nov.) 1933.

The author considers the following points:

1. The various mineral and organic dusts which are hazardous to health.
2. The benefits from the increasing use of humidity and temperature controlled air, in home, office and public places.
3. Symptoms and manifestations due to allergy from air borne pollens, animal emanations, house dusts and other inhalants.
4. The degree of control and the impossibility of the cure of such allergy by the use of pollen filtering and dust removing devices. Finally, it is especially desired that this contribution may stimulate thought and endeavor which will help toward the realization of dust-free industry and lessen the possibility of allergic disturbances from air borne substances.

Combined Arsphenamine-Ultraviolet Therapy.

Editorial, J. A. M. A., 101:1158, (Oct. 7) 1933.

The possibility of increasing the therapeutic effects of arsenicals by the simultaneous use of ultraviolet rays has been extensively studied during the last three years by European investigators. Orlow and Lewinson of the venereal institute at Moscow studied the curative effects of combined arsphenamine-ultraviolet therapy on experimental syphilis in rabbits. They report that ultraviolet radiation increases the spirocheticidal effects of neoarsphenamine and does not demonstrably increase its toxic effects. It causes substerilizing doses of the arsenical to become therapeutically effective. They unhesitatingly recommend its clinical trial. A definite rationale for this combination therapy has been suggested by other investigators. Roskin and his co-workers, for example, state that exposure of mice to ultraviolet radiation causes a new immunity factor to appear in the blood stream. This "factor" is without direct effect on trypanosome infections. Transferred to non-irradiated mice, however, the factor greatly increases the trypanocidal action of arsenicals. From a study of splenectomized and endothelial-blockaded mice they believed that the new factor is formed or secreted by the reticulo-endothelial cells.

Effects of Radiation on Allergic Nasal Mucosa.
L. B. Bernheimer, M. Cutler.

Arch. Otolaryngol., 16:561, 1932; 17:658, 1933.

Inasmuch as the therapeutic results of vasomotor (hyperesthetic) rhinitis by medical, surgical and allergic methods have been frequently disappointing, a consideration of the known effects of radiation on normal and pathologic nasal mucosae suggested to Bernheimer and Cutler the use of radium to correct the local pathologic process encountered in allergic nasal conditions. Accordingly, 40 patients with hyperesthetic rhinitis were irradiated — all of whom had experienced periodic paroxysms of sneezing followed by profuse rhinorrhea and nasal block, which occurred independently of season or climate. The intranasal structures were pale and waterlogged. Of the 11 persons yielding positive cutaneous reactions to various allergens, none had been benefited by allergic therapy. Only temporary improvement had followed numerous surgical procedures in 29 of the 40 cases. All the irradiated patients were free of polypi and secondary nasal infection. After topical cocaineization a capsule containing 25 mg. of the radium element — total filtration being 0.5 mm. of silver and 1 mm. of brass — was placed in the middle and inferior meatuses of each nasal chamber for 2 hours — a dosage of 200 mg. hours. The morphologic and clinical response was uniformly striking — all the patients being appreciably benefited during the first 6 months. In a second communication the same authors report that after 1 year, 52 per cent of these 40 irradiated patients were symptom-free; 20 per cent no longer had nasal block or watery discharge, although sneezing persisted in a moderate degree; 8 per cent were fairly comfortable; 10 per cent had received but little relief, and 10 per cent had not been benefited. No untoward sequelae from their method of irradiation were observed. The authors frankly state that they regard the procedure as an empiric one and offer it solely as a useful adjunct in the many cases in which specific therapy had failed to correct the allergic state. — A. J. M. Sci., 186, (Nov.) 1933.

The Genetic Foundations of X-ray Mutations.
Paula Hertwig.

Str. Ther., 45:657, 1932.

This paper discusses the results of the experimental work of several authors on mutations, for the purpose of drawing conclusions as to the possibilities of germ injuries in man after therapeutic and diagnostic x-ray applications. H. T. Muller in 1927 reported first about an increased mutation rate of *drosophila melanogaster*. Chromosome mutations in mice have been reported by Gates and Painter in 1929. The rate of mutations is in ratio to the dosage and is independent of the wavelength of the rays. A threshold does not seem to exist, since 100 r caused a significant increase of mutations. From a further discussion of the inheritability of the mutations, the author draws the following conclusions: "The genetic experiments prove, that inheritable mutations occur after x-ray irradiations. It is prob-

ably that most of the mutations are undesirable. But even the possibility of inheritable germ injuries in man suffice to call attention to the danger."

Effects of X-ray Exposure Upon the Mineral Metabolism of Implanted Rat Tumors.
L. Kluge and H. G. Zwerg.

Str. Ther., 46:293, 1933.

X-ray irradiation of rat sarcomas causes an increase of the tumor calcium, up to 400 per cent, and usually a decrease of the potassium and magnesium content. These effects are most pronounced in adult female animals. They are not only produced by direct application to the tumor, but also by exposure of other parts of the body, particularly the hypophysis. This suggests a mobilization of hormones, which is most readily produced in adult female animals.

Electrosurgical Incisions. Histologic Effects.
John D. Ellis.

Arch. Surg., 26:1980, (June) 1933.

The author presents a detailed discussion of effects of electrosurgical incisions, introducing histopathological studies of tissues that have come under the influence of electrocutting and electrocoagulating current. The hope and expectancy from electrosurgery is the attainment of two technical advantages: (1) the sectioning and control of capillary hemorrhage in vascular tissues and organs difficult of surgical approach; (2) an incision which will approach the effect of a scalpel wound in its healing reaction without excessive fibrosis. His conclusions indicate that two distinct types of tissue effect can be produced by electrosurgical machines. These types of tissue effect depend on the qualities of current employed. The more the damping and the higher the amperage, the greater is the amount of coagulation accompanying the tissue section. Both the cutting and the coagulating currents have special indications and advantages in surgical practice. Massive coagulation of tissues with subsequent sloughing of the necrotic area is undesirable as a surgical procedure. The present electrosurgical technic consists of excising a portion of tissue with the cutting or coagulating current.

Two types of electrosurgical machines are in common use; in one the frequency of oscillation is produced by a multiple spark gap and in the other by radiatrons (radio tubes). The first always produces a somewhat damped current. As the damping is diminished the incision more nearly approximates the scalpel cut. As the damping increases the amount of coagulation increases. The radiotron machine can produce a cut without coagulation, as the current is not damped. By increasing the voltage and amperage in this machine, coagulation results. This is likely to be associated with a charring if the amperage is too high. This prevents penetration of the coagulating effect into the tissues.

Impressions After Ten Years' Use of Radium in Gynecological Conditions. Pat Fite.

J. Okla. S. M. A., 26:406, (Nov.) 1933.

The author's report, based on conclusions reached after ten and one-half years, states that a radium salt representing fifty milligrams of radium with brass screening was used throughout. The following conditions are treated by the author and his results given: (1). Carcinoma of cervix—five-year cures on approximately 25 per cent, and in an additional 60 per cent, marked alleviation of symptoms; (2). Carcinoma of the fundus uteri—radium used only with idea of palliation in inoperable cases; (3). Bleeding at the menopause—constitutes the easiest and most certain treatment; (4). Menorrhagia and Metrorrhagia from other causes of a questionable function—suitable in selected cases, especially obstinate cases in younger women; (5). Fibroid tumors of the uterus—intramural type of fibroid probably best suited, the subserous and submucous varieties less so; (6). Uterine Polyp—should in most cases be treated by surgical removal—radium used if in older women; in younger women, only after second operation; (7). Endocervicitis—only fair results prefer cauterization or some form of surgery; (8). Carcinoma of the urethra and vaginal wall—condition rare, except as secondary growths, and usual treatment otherwise is followed. The author concludes that the mortality is comparatively rare, the hospitalization brief, and, where indicated its use is superior to surgery.

General Effects of Diathermy and Ultraviolet Radiation in Bronchial Asthma. A. Evers.

Die Medizinische Welt, May 29, 1933.

Evers treated 150 cases of bronchial asthma, more of them in latent stage by the above combination. Diathermy was administered daily to the chest through two large plates, 1000 ma. for 20-30 minutes, 20-25 treatments in average. Ultraviolet was given from a new mercury quartz burner to six separate fields in the chest (8x10 inches) for 10-13 minutes at 40 inches, 6-10 "erythema doses" in average. The advantage of this combination is the favorable local effect and the general "revulsive" effects.

Sixty cases were examined on empty stomach by laboratory methods for general effects. The results were surprisingly consistent. The blood was tested before treatment and about 30-50 minutes after its ending. The following results were found after chest diathermy: In 20 cases there was an average drop of 19 per cent in blood sugar and 13-40 per cent in the leucocyte count. The neutrophile cells increased and the lymphocytes decreased in number. Basal metabolism decreased 9-15 per cent, 10-30 minutes after the treatment.

The changes after ultraviolet radiation were more numerous but less consistent. The average drop in blood sugar 40 minutes after irradiation was 13.8 per cent; the drop was the same after each irradiation whether it was the first or the

sixth. Leucocytes increased to the extent of 70 per cent; if there was no increase, the irradiation was ineffective on account of strong skin pigmentation, for instance when a field of a previous erythema was irradiated for the second time. There was little relative change in the number of lymphocytes and neutrophiles. No changes in the blood picture and blood sugar could be observed with the ordinary slowly increasing dosage of irradiation; the gradual adaptation of the skin prevents general effects. Irradiation of the nasal mucosa caused a drop of blood sugar of about 13 per cent in 70 per cent of the cases.

The interpretation of these changes is as follows: The general effects of local diathermy through the chest are those of intracutaneous irritants, while the erythema doses of ultraviolet act like foreign protein therapy. These effects call attention to the close relationship between skin irritation through physical measures and the vegetative nervous system.

Influence of Diathermy and Short Wave Diathermy on Renal Hypertony. Z. Rausch.

Zeitschr. f. d. ges. Phys. Ther., 45:4, (Oct. 18) 1933.

Author's report is based on work done at the Third Medical (Koranyi) Clinic of the University of Budapest, the research work on kidney function done at this clinic being well known the world over. In two previous papers on the subject author has shown (1) that most patients suffering from renal hypertony can be favorably influenced by diathermy, (2) that best results are accomplished in patients with chronic nephritis (nephrosclerosis) in the stage of labil hypertony; in these cases it is possible to keep the blood pressure for months at a low level and to free the patients completely and continuously of their symptoms; (3) in rigid hypertony and chronic nephritis it is possible to bring about a fairly rapid and extensive subjective improvement, but there is less possibility for objective changes.

The author states that diathermy of the kidneys accomplishes a relaxation of the vasoconstriction in the kidneys and in turn decreases high blood pressure because the dilation of the kidney vessels enables the heart to adapt itself to the lowered resistance, and this results in the lowering of the aortic pressure.

The kidneys offer a favorable object for diathermy because there is not much difference in the electrical resistance of the surrounding tissues and a fairly even heating occurs. The heat effect in the depth is limited due to the dissipation of the electric energy necessary for the heating of skin, fat and fascia. The newer method of high frequency short wave therapy permits a more efficient, more simple, and much safer method of diathermic treatment. A pair of condenser electrodes attached to a short wave (30 meter wave) apparatus, treatment period of one-half to one hour, with milliamperage of 2,000 to 2,500 results in a rapid fall of blood pressure which persists longer than following ordinary

diathermy. In milder cases of nephrosclerosis it was possible to bring about in four or five treatments a considerable lowering of the blood pressure and almost full relief from subjective symptoms. Of twenty-eight cases treated half received short wave diathermy and it was possible to keep them free from symptoms for many months by treatments continued at an increasing interval.

Influence of Moor Baths on Blood Pressure. H. Guthmann, and L. Hess.

Monatschr. f. Geburtsh. u. Gynak, Berlin, 94: 55, (April) 1933.

Guthmann and Hess found that a hot moor bath decreases the systolic pressure. This decrease is more pronounced in medium warm baths than in really hot baths. The authors were unable to corroborate the increase in blood pressure which a number of other investigators claimed to have observed as a result of hot moor baths; for neither the average values nor the individual values showed an increase in the majority of patients. The so-called terminal increase of the blood pressure becomes more noticeable as the temperature of the bath increases. The diastolic blood pressure decreases immediately following the beginning of the bath. In warmer baths and in full baths the decrease is somewhat slower. The amplitude is temporarily increased during the bath. This increase becomes more pronounced as the bath gets warmer. Less hot, full moor baths exert the same influence on the blood pressure as hotter half moor baths. Thus the moor baths can be individualized by giving a half or a full moor bath, or by changing the temperature and the duration of the baths. The authors' observations prove that in women with normal heart action a series of moor baths does not alter the blood pressure.

A Wood's Glass Diagnosis Lamp for Twenty-five Shillings. J. H. Twiston Davies.

Brit. J. Dermat. and Syph., 45:193, (May) 1933.

The appearance on the market of a special mercury vapor lamp fitted with a Wood's glass filter for the diagnosis of ringworm, has prompted me to describe a more simple contrivance which has served me very well for the same purpose.

The use of a small carbon arc for this purpose was first suggested to me by seeing in a photographic dealer's, a minute arc lamp sold under the name of Meteor Heim-sonne. (I find that the use of a small carbon arc for this purpose was also suggested by Roxburgh, Brit. J. Dermat. and Syph., 1927, 39:352.) I instantly acquired this little lamp and fitted a tin can over the opening of the reflector, fastening the piece of Wood's glass over a hole at the other end of the can. I soon ascertained that a small carbon arc of this kind would serve my purpose;

but the inadequate size of this little lamp caused it to become over-heated very quickly, the insulation breaking down, and the carbon holders fusing on the third or fourth occasion on which it was used.

From the following materials, some of them obtained from Woolworth's, and the rest discovered in a collection of ordinary household jetsam, the lamp was constructed: 1 enamel bowl, 6 in. diameter; 1 cake tin, 7 in. diameter; 1 cake tin, 4 in. diameter; 1 electric light bulb holder more or less incomplete; stand of a derelict reading lamp, which serves as the handle. The Wood's glass filter.

The Wood's glass is mounted in a block of wood, covered with thin asbestos card on the inside, and there are ventilating louvres in the cake tins designed to permit a current of cold air to pass over the surface of the glass. I have found this lamp, in the form described, so useful that I have persuaded the engineer at the Royal Sussex Hospital to duplicate it for me for my use there.

Light and Tar Cancer. M. G. Seelig, and Zola K. Cooper.

Surg., Gynec. and Obst., 56:752, 1933.

In order to determine whether light has any influence in the production of tar cancer, mice were painted with a fraction distilled at 370-440 degrees C. without exposure to light, and stored subsequently in the dark. The animals were maintained on food which was guarded from access of light as completely as possible and were kept in a room that had been proved light-tight by exposing highly sensitive photographic plates in it for forty-eight hours; when developed, they showed no evidence of fog.

The experiment was not begun until the mice (125 males, about three months old) had been in the dark room for three weeks. A similar group of 125 were tarred in the light, while a third lot, consisting of 50 young males, were not painted but served merely as a check on living conditions in the dark.

Applications were made in the customary way between the scapulae, once or twice weekly for twenty weeks, or twenty-three times in all. During the last four weeks of the experiment tarring was discontinued. A diagnosis of cancer was made only if neoplastic epithelium was found infiltrating the subcutaneous layers of muscle.

White light was found to be not a necessary factor for the development of tar cancer in mice, for more carcinomas developed in those kept in darkness, though the difference was not great enough to warrant the conclusion that absence of light favors the inception of carcinoma.

The authors conclude by summarizing a number of articles dealing with light and cancer, both in man and the lower animals, and draw from their survey the deduction that additional experimental evidence must be furnished if current hypotheses are to be confirmed or conflicting assertions evaluated. —A. J. Cancer, 19, (Oct.) 1933.

MEDICAL DIATHERMY IN PROSTATITIS AND SEMINAL VESICULITIS *

ALFRED E. JONES, M.D.

CHICAGO

We are all agreed that the therapeutic efficacy of diathermy is based on the production of heat within the tissues by transforming electrical into caloric energy. To introduce intrastructural heat without any undesirable side effects, such as muscular contractions, electrolysis and pain, requires the employment of high frequency currents as the source of electrical energy. Heating through of tissues actually produces two biologic reactions: Stimulation of the blood and lymph circulation, and the attraction of the defensive cells of the body to the areas of increased metabolism. That these cells are intimately connected with all phases of immunization is today a recognized fact. If therefore one considers the therapeutic difficulties presented by prostatitis and seminal vesiculitis, the proper administration of this form of heat very forcibly suggests itself as the most direct therapy at our command.

In no branch of practice has medical diathermy proved itself more useful than in the management of certain morbid conditions occurring in the genito-urinary tract. It has been directed especially toward the very prevalent gonococcus and its ravages upon human tissues, but its usefulness is by no means confined to this infection alone. As the activity of the circulation is increased by heat, the blood carried to the area under treatment will also be supplied with elements for combating infection. At the same time, the increased temperature in itself has a marked bactericidal effect. Graves⁽¹⁾ has aptly expressed it when he said: "Heat serves a double purpose in producing conditions more favorable for the host and less favorable for the invading organisms."

The value of diathermy is generally better appreciated in acute conditions than in those of long standing, and it is for this reason that we wish to emphasize our success in chronic prostatitis and seminal vesi-

culitis. This should not be taken to mean that we are opposed to its use in acute conditions. On the contrary, medical diathermy applied to these organs during the acute state brought immediate relief to some of the most distressing symptoms under our observation, and has undoubtedly played a conspicuous part in the permanent eradication of the disease. The application of heat to these structures assures absorption of inflammatory products, hence "stripping" is made easier and the reaction rendered more satisfactory. This in turn is also of aid in the final control of the morbid condition. The distressing, referred pains, which are so often an accompaniment of acute inflammation of the prostate and vesicles, are very promptly relieved by suitably applied medical diathermy.

Chronic Cases. In obstinate prostatic and vesicular inflammation which has existed for long periods and proved resistant to all the regular methods of treatment, diathermy has, in our opinion, brought about remarkable results. Some of these patients had for years been receiving massage, silver nitrate, and other instillations, and all the other traditional treatments of prostatitis and vesiculitis without any definite improvement. When these same patients received diathermy, alone, the improvement was striking. In other cases diathermy was combined with protein therapy and this combination has sometimes proved more effective than either method used exclusively. Protein therapy without diathermy has not been fully satisfactory in our experience. Not all patients react equally well to any one form of treatment. The individual must be studied and the treatment decided upon after a careful consideration of all factors. But our success with this method has been so uniform that we have no hesitation in urging those who have never tried it to do so.

Adjunct Protein Therapy. The value of this relatively new method of treatment of

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 14, 1933.

inflammations of prostate and vesicles can hardly be overestimated, because if we except Belfield's⁽²⁾ operation of vasostomy, introduced in 1913, and medical diathermy suggested by Kolischer in 1920, nothing new has been added to our resources for combating these conditions in more than a quarter of a century. As chronic prostatitis and vesiculitis are practically always coincident, our efforts must be directed against inflammatory conditions in both of these parts of the genito-urinary tract. The addition of protein therapy to diathermic treatment, using both stock and autogenous vaccines as well as the various forms of nonspecific proteins, is widely accepted as a worthwhile procedure, but it has been our experience that though a most valuable aid, it should only be considered as such.

Limitation of Surgical Treatment. The method employed and advocated by Belfield, which consists of an incision into the vas deferens through which a needle can be passed and antiseptic solutions injected, was a marked advance over the previous attempts to reach inflammatory areas in this part of the genital canal. Nevertheless, the wide popularity first obtained by this method has now subsided, and we find few urologists employing it today despite the fact that it is by far the easiest and simplest manner of applying medication direct to the vesicles. Its usefulness has not stood the test of time.

Incision and drainage of the chronically infected prostate and vesicles are advocated by Morrissey⁽³⁾, of the New York Hospital, who published a number of papers on this subject some eight or ten years ago. His results in large series of cases, such as are available in huge metropolitan clinics, are impressive; but his technic, which he describes as "a combination of the methods devised by Young and Squier (with) . . . a number of new features and conservative modifications which contribute largely to the safety of the operation," is far too elaborate to be carried out anywhere except in surroundings such as are available to Morrissey, himself. In the routine of urological practice many patients are seen who must have relief, yet are unwilling or unable (financially or otherwise) to undergo such an operative procedure. Yet they are equally unwilling to continue the oldtime massage,

sitz bath, hot rectal douche and silver solution instillations, all of which are the usual alternatives to surgical intervention.

Value of Diathermy

For the average sufferer from prostatitis and seminal vesiculitis — the type of patient who makes up a large percentage of everyday urologic practice — diathermy offers a middle course between surgery and palliative treatment, which in our experience has stood the test of more than ten years constant employment and still remains the most efficient and generally satisfactory means of dealing with these troublesome conditions.

The only drawback which can be cited against diathermy in the therapy of these pathologic states, is the amount of time which must be spent in its application. We have found that unless the patient receives the diathermic current for at least thirty minutes, we cannot look for much improvement. The Greenbergers assert that the duration of treatment should be at least forty-five minutes, and a full hour is preferable. They found the point of tolerance usually to vary between 500 ma. and 1700 ma. The patient is placed in the dorsal position and the rectal electrode lubricated and introduced very slowly until the metal surface comes in direct contact with the point of greatest tenderness. In this way they claim to have aborted acute prostatic abscess.

This appeals to us as being slightly heroic treatment. The mistake is often made of applying too much heat, so that instead of stimulating the defensive forces we inhibit them. This of, of course, precisely the opposite of the effect we desire to obtain.

Individuals vary greatly in their tolerance to heat, and this must be gauged before the treatment is instituted to its fullest extent. If one "sneaks in" with the current until the patient is sensible only of a soothing warmth, his capacity will be readily estimated. To ascertain this requires about five minutes of treatment and the reading of the amount of amperage registered by the milliamperemeter. Painful contractions of the rectum, which sometimes occur during the first few treatments gradually disappear and the rectal tolerance increases with each succeeding treatment. If the rectal electrode is supported or held

in place by sandbags, the annoyance of its possible slipping out of place is prevented. Each instrument is a unit in itself and so is the reaction of each individual patient. We cannot manipulate the machine by rule of thumb any more than we can ignore the idiosyncrasies of the individual. The same caution must be observed with each patient and at each session.

Review of Cases of Chronic Prostatitis and Vesiculitis

In our office records for the past ten years, we find 210 cases of chronic prostatitis and seminal vesiculitis that have been treated by diathermy alone, or by diathermy in combination with protein therapy. The average number of diathermic treatments received by these patients was 24; the average number of protein injections, 6. The greatest number of diathermic treatments in any one case was 56; the highest number of protein injections, 14. One patient was under treatment for four months but the average time of treatment was six weeks.

Of the entire series, 78 per cent are listed as having obtained a definite clinical cure. This is taken to mean complete relief of all subjective symptoms, with the urine clear on repeated examination. In addition, 28 cases, or approximately 13 per cent showed marked improvement from the standpoint of relief of the most distressing symptoms with a reduction of the bacterial count in the urine, although the urine was not wholly free from pus when the treatment was discontinued. Eighteen cases, or about 9 per cent showed no definite improvement either symptomatically or clarification of the urinary sediment. A few in this group admitted some relief from pain, burning, frequency of urination immediate-

ly after the treatment, but they stated that this relief was but temporary, lasting at most until the next day. These cases we were obliged to recognize as failures, surgery being the only recourse left for them. It is most instructing and interesting, however, to note that not a single one of these records shows that our recommendation for surgery was accepted.

Conclusions

Considering the remarkable resistance to treatment usually displayed by chronic inflammations of the prostate and vesicles, a ten-year record of having cured clinically practically eight out of every ten patients by a combination of diathermy and protein therapy, represents a result of notable achievement and one offering a strong recommendation for that therapeutic procedure.

We also feel that the efficiency of protein therapy has been shown to be greatly enhanced by its use in connection with locally applied diathermic treatments. We regard this combination as far superior to any other method of treatment now employed in urologic practice for these chronic inflammations.

A wider appreciation of the simplicity and efficiency of the method will lead to a very general raising of the average of success in the management of these vexatious and stubborn conditions.

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(For discussions turn to page 397)

DIATHERMY IN UROLOGY*

WILBUR H. HAINES, M.D.

PHILADELPHIA

From earliest times primitive and civilized peoples have resorted to heat for the relief of pain. With the discovery of electricity, the medical profession was quick to recognize a physical agent capable of producing an intense and refined heat that, properly applied, possesses unlimited value in the relief of many human ills. We are living in an electrical age, the advances of which have been marvelous, and yet the surface has scarcely been scratched. The same may be said of diathermy in medicine and especially in urology. The urologists have more than kept pace with this electrical era, and much of their progress is due to the enthusiasm and inspiration received from this Society and in particular from men like Kolischer, Kretschmer, L. E. Schmidt, Corbus, O'Connor, and Coulter. Beer's announcement in 1910 of a transurethral method of destroying bladder tumors by the high frequency current was truly a milestone in urological diathermy. Stern, Davis, Caulk, and McCarthy have planted another milestone by giving us a transurethral diathermic method of prostatectomy. Many others have contributed to this development.

Remove diathermy from the urologist and he is comparable to a sailor who has lost his tiller. He can't work to windward. There is scarcely a urological entity to which diathermy has not been applied. It is one of the greatest forces in modern urology, a prophylactic measure capable of preventing cancer by destroying all precancerous lesions of the bladder, urethra, and external genitalia (benign papilloma), the prevention of serious hematuria in ulcers and rupture of the bladder, the probable prevention of severe prostatism and all its concomitant pathology, by early resection. Medical diathermy relieves pain, reduces swelling and aids in resolution in epididymitis, orchitis, acute prostatitis, arthritis, and cavernositis, thereby obviating abscess formation and subsequent operation.

Unfortunately electrotherapy in the early days carried a taint of fraud and quackery,

due in part to the strict limitations of the older apparatus, to the mystery of the electric current itself, to the type of individual who applied it for commercial gain, and to the absurd claims of cures made by certain men. We are not entirely rid of this taint and unless there is a humble statement of the accuracy of results, and a careful evaluation of these, a good weapon is going to fall into disrepute. Diathermy should only be used where simpler and more economic methods do not suffice. Dr. Hugh Young sounded a timely warning last June in discussing transurethral prostatic resection. He referred to the danger of the urologist reverting to the old position of office specialist or "clap" specialist, an odious reputation that took us twenty years to overcome. One man told me he was doing resections in his office. This is wrong. Surgical procedures generally should only be carried out in the hospital, and this also applies in some instances to medical diathermy. No phase of surgery requires more experience, greater judgment, more skill and finesse of technic than the proper application of diathermy to urological diseases.

Medical Diathermy

Medical diathermy or sedative diathermy generates heat in the body tissues in proportion to the square of the amperage used and the tissue resistance to the passage of the current. Because of the high voltage, the direct resistance of the tissues is not an important factor. Because of the extremely high oscillation rate of the current, approximately one million per second, there is no muscle contraction, no ionizing effect, but only sedation and the development of heat and active hyperemia. The sedative effect upon nerve endings has been demonstrated by decreased pain and diminished electromotor responses. Active arteriole and capillary dilatation follows the accumulation of heat within the tissues. This increases the local blood supply and the amount of lymph rich in repair material (phagocytes and anti-bodies) which passes into the tissues. The dilatation of the capillaries quickens the venous return due to the lowering of the capillary resistance to the

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blood stream. While a current is usually employed which would coagulate non-living protein, it is attended with no such result in normal vascular tissue. The only contraindications are inflammatory conditions with pent-up pus, where obviously such treatment would increase the toxemia and tend to septicemia, lesions where hemorrhage might occur, and in peripheral nerve injuries where heat sensation might be impaired or lost.

Acute Specific Urethritis. We have tried diathermy in a few cases and were disappointed with the results. This appears to be the general experience of the profession. The gonococcus in culture will survive thirty minutes at a temperature of 113 degrees F. How can one expect to kill the gonococcus *in vivo* by heat, when it is virtually impossible to hold that degree of heat in the tissues? Furthermore, the very method suggested breaks a very old cardinal rule of treatment, "Do not instrument the urethra in the presence of an acute infection." Granting the rule wrong, no electrode has been devised that would meet the requirements of an active electrode for the urethra. We have noted subsidence of pain and edema in acute fulminating gonorrhea by simple immersion of the organ in hot normal saline solution for 20 minute intervals.

Gonococcal Endocervicitis. We have treated 19 cases of this infection because they were forced upon us. We are not gynecologists and we reluctantly accept such cases for three reasons:

1. Our belief in Dr. Agnew's statement made 100 years ago — "A woman once infected, always infected."
2. The necessary time involved and lack of cooperation in some patients.
3. A negative smear means nothing in the female.

Eleven of the 19 thought they were cured. We used diathermy treatments in conjunction with other administrations. They were all under our care from six months to fourteen months, and 8 cases were definitely infectious when they stopped treatment. Diathermy was of some value in this condition.

Acute Prostatitis and Seminal Vesiculitis. In hospital practice for the past twenty years, routine treatment has been the instillation every third hour of 250 cc. hot normal saline solution, hotter than the finger can endure, yet instilled without injury to the skin, and

retained for twenty minutes, if possible. This has usually sufficed. In a few instances we have resorted to diathermy, using the prostatic electrode with a thermometer, never above 45 degrees C., for forty minute periods. This requires 1300 to 1500 milliamperes. The patient rarely complains of heat, but of a heavy bearing down sensation which we take as a warning signal. This method has been employed several times at the hospital and sixteen times at the office. Catheterization may be necessary because of acute retention. Applications may be made twice daily. Upon relief of the severe discomfort, very gentle massage is practiced and not infrequently quantities of yellow pus will be expressed. The results are generally gratifying. We have performed prostatotomies twelve times in fifteen years and the majority of these cases were abscessed upon their initial visit.

Chronic Prostatitis. Prior to the depression we massaged our chronic prostatics twice weekly on a full bladder. Despite only fair results, the patients kept coming. They furnish the financial background of any large office practice. For the past three years we have used diathermy on many of these cases because we were not pressed for time. The technic is the same as described above. The vague symptoms which many physicians regard as "neurotic" are promptly relieved. This sort of treatment is time consuming and requires extra office space and assistance. We are convinced that most patients after two or three treatments are willing to compensate for the extra time and trouble.

Epididymitis. That diathermy is the treatment of choice in epididymitis admits of no argument to those who have given it a fair and honest trial. In office work it gives immediate relief to pain and with three or four treatments the swelling subsides. Not infrequently the patient resumes work the same day. Formerly, in hospital practice we used the Bellevue strap with local heat. Today, we are using only diathermy. Our results are better and the stay in the hospital is much shorter. They receive one or more applications daily, depending upon the severity, and the availability of the machine and attendant. In the past year we have only done two epididymotomies for the relief of pain and both of these were recurring cases.

The technic (Grant and Cutler) consists in

immersion of the entire scrotum into a small earthenware bowl containing normal saline solution. The posterior surface of the scrotum rests against the tin foil, which about half lines the bowl. Rubber dam is used to protect the scrotal skin at the upper edge of the foil. The inactive electrode may be placed over the suprapubic area or sacrum. The accurate placing of electrodes is important, and there must be an even flow of current. The toleration point in our machine is approximately 800 milliamperes. A forty minute period generally suffices to relieve pain. A case of "lover's" orchitis was promptly relieved by one treatment.

Gonorrheal Arthritis. Prior to one year ago we used diathermy with very satisfactory results. During the past year we have tried another measure; namely, the aspiration of fluid from the joint and the injection of approximately the same volume of air as fluid withdrawn, into the joint. There followed immediate relief of pain and subsidence of swelling in 6 cases. They all left the hospital within 3 days. This may seem incredible, but it is true. The small number of cases treated does not justify any conclusion. A report on 25 cases will be forthcoming in the near future.

Nephritis and Ureteral Calculus. Anatomically these structures are rather too deeply seated to be influenced very much by diathermic heat. Friedman was unable to influence diuresis experimentally in dogs. His results are in accord with those obtained by Bronner and Schüller on the human kidney. Eppinger and Ewig claim to have increased diuresis by diathermy on both the healthy and diseased kidney. Kolischer and Jones think diathermy is of value, if applied early. The pain of ureteral calculus may be relieved by pantopon gr. 1/3, hypodermically.

Surgical Diathermy

Surgical diathermy produces destruction of tissues by raising the localizing heat within them to the point of coagulation. Advantages over the operative procedures are:

1. Certain otherwise inoperable tumors may be removed.
2. Little or no hemorrhage.
3. Danger of metastasis is lessened.
4. Sterilization of operative field by the heat.

5. Less surgical shock.

6. Operation is frequently rapid and not difficult.

External Genital Lesions. Electrocoagulation is the treatment of choice in benign papilloma of the penis (venereal warts), polyps, or other benign growths of the urethra. Circumcision in venereal warts is necessary to prevent recurrence. During the past year five cases of hematuria in the female were encountered, all of which were due to apparently benign growths of the urethra. We suspect this is a frequently overlooked cause of hematuria in the female. If in doubt as to the benignity, slow coagulation followed by deep x-ray therapy is indicated.

Epithelioma, usually the sequel of warts or some chronic ulcerative condition about the glands, is managed in much the same manner. Carcinoma of the penis is of slow growth and usually occurs late in life. Pre- and post-operative x-ray therapy are indicated along with block dissection of the superficial and deep lymph nodes. Amputation of the penis at the peno-scrotal junction with the electro-knife is an easy and satisfactory procedure, due regard being had for efficient skin flaps and the urethra, which should be freed and sutured to the skin, thus insuring a good external meatus that will not stricture. Indiscriminate amputation without regard for flaps or urethra is to be condemned. In one instance I was called to the hospital at 1 A. M. to relieve acute retention, the urethra having disappeared on the fourth day after amputation. It was located. This is a surgical procedure for a trained urological surgeon. A patient seventy-four years of age with a foul, sloughing growth involving nearly the entire pendulous penis was correctly treated last April with a very satisfactory cosmetic and functional result. He is doing unusually well, having gained fifteen pounds.

Chancroid. The first object should be the elimination of lues by routine diagnosis. Cases of phagedenic chancroid are troublesome. Robbins and Seabury's method of applying 25 per cent copper sulphate and using the vacuum electrode under local anesthesia or electrocoagulating directly with a needle as suggested by Corbus, being sure to reach the undermined edges, usually suffices. In one instance, all the above methods failed and a constant Dakin drop for seventy-two hours was necessary. The patient lost more than half of his

glans penis before the infection was controlled.

Vesical Neck Obstruction. Transurethral resection of the prostate is the most recent addition to urologic surgery. We used it indiscriminately for twelve months and the writer has published a preliminary report on fifty-one cases. Some idea of our opinion may be obtained from the following statement: Since April, which terminated the twelve months' trial period, we have used it five times and performed prostatectomy nineteen times. It is unquestionably a valuable addition to our armamentarium, if used in carefully selected cases. In prostatic carcinoma and median bars it has no equal, providing instrumentation is possible and the risks are good. It is an honest effort to relieve prostatism where inoperable risks are encountered. In six such instances the results were fairly satisfactory, the patients improved clinically, and there were no absolute failures, which was probably a matter of luck. However, the convalescent periods were long and stormy which was to be expected. We have had two failures. In one instance the patient could void some before resection and could not void at all after it. We have since prostatectomized these two patients. In both instances the entire median lobe and about one-fourth of either lateral lobe had been entirely resected. Enucleation of the remaining lateral lobes has restored the urinary function. In over 50 per cent of our resections, infected bladders of long standing occurred despite the alleged sterilization by diathermy. It may be due to faulty technic, but to date we have not conquered this postoperative cystitis. Despite the assertions of other resection enthusiasts, we know of two cases turned out by a pioneer in this work as cured, where the bladders were still infected after a period of eight months.

At the present time we are not resecting large lateral and median lobes with definite lines of cleavage, as determined by cystoscopy, and where there is a good operative risk. In one instance we satisfactorily resected a small intraurethral lobe which was overlooked following a prostatectomy. We believe that transurethral resection will have its greatest field of usefulness in early prostatism, as a prevention of large hypertrophies. All men reaching the fifth decade should be questioned

as to clinical manifestations of early prostatism and examined by rectal palpation and intravesically.

Papilloma of Bladder. Papillary epithelial tumor of the bladder is most common, comprising about 90 per cent of the new growths in this viscus. It practically always originates as a benign growth, but possesses in its constituent cells a strong inherent tendency to malignancy (occasionally a papillary tumor from its inception may show clinical and architectural characteristics of malignancy). Why this change takes place in the cell, we do not know. It is the experience of all urologists that the manifestations of this malignant tendency varies within the widest possible limits both as regards time and intensity, and that if unrestrained by treatment, the occurrence of malignancy is inevitable. It is, therefore, evident that a large majority of these papillary growths should offer ideal conditions for prophylactic surgery, i. e., diathermy. Unfortunately, in actual practice we find 75 per cent of such tumors presenting malignant characteristics when first seen. This indicates senility of the tumor in the biologic sense and an unwarranted delay in instituting proper treatment. Gross hematuria occurs in 60 per cent of cases. Microscopic red blood cells in the absence of an obvious medical cause, such as an acute nephritis, is a definite indication for complete urological study. Symptomless hematuria is suggestive of a benign growth when due to vesical neoplasm. The latter are rarely complicated by infection or stone. Cystitis not following instrumentation in association with a papillary tumor is highly suggestive of malignancy.

It is to be remembered that certain papillary cancers of the bladder will respond to diathermy if the cellular change is limited to the periphery, and at times when there is slight invasion of the pedicle. Up to this point transurethral diathermy is the treatment of choice, provided the growth shows immediate response. It can be destroyed in one treatment, usually under local anesthesia.

If there is definite cystoscopic evidence of invasion to the bladder wall, and the location is suitable for resection, this should be done suprapubically and electrosurgically, preceded and followed by x-ray therapy. Regarding malignant tumors not favorably situated for clean resections, there is much difference of opinion. The four agents employed are dia-

thermy, radium, x-ray, and surgery, alone or in combination.

Radium we have not used in eight years. In every instance, it aggravated the clinical picture and actually hastened death. Either we do not know how to apply it or radium just happened to "click" with the chemical activity of the chromosome. In substantiation of our experience we quote McCarthy: "The army of radium enthusiasts of a few years ago has dwindled to a corporal's guard."

A report from the Mayo Clinic by Counselor and Walters of 17 cases of infiltrating carcinoma confined to the base of the bladder treated by transvesical diathermy is interesting. These were considered nonresectable. Sixteen of the 17 patients lived from 5 to 15 years and one patient lived more than 10 years. There were 5 recurrences — 29.2 per cent. Fifteen, or 88 per cent, of the 17 patients are living and free from bladder symptoms. A reasonable conclusion is, that considering these cases were judged inoperable, the results indicate that those living less than 5 years, treated by diathermy, lived longer and in greater comfort because of this treatment. Furthermore, should it not be considered a very effective method of treating the more favorably situated and less malignant growths? The Mayo clinic further reports 600 patients treated from 1910 to 1927 by the various methods demonstrating that 165, or 28 per cent, were cured for 5 years or more. Sixty-seven, or 40.6 per cent of the 165, had recurrences. In 55, or 33 1/3 per cent, the lesions involved the trigone, base, urethral and ureteral orifices. In 151 cases of the 165 patients the malignancy was graded: 38 were grouped as grade 1; 67 as grade 2; 30 as grade 3; 16 as grade 4. Sixty-two per cent of grade 4 are still living. The percentage of recurrences in all grades was uniform. The relative high percentage of 5 year cures in grades 3 and 4 is striking, but serves to emphasize the importance of treating malignant tumors of the bladder which at first seem inoperable. It would appear from the above report that grading is not going to be of great help in the selection of treatment.

During the past winter we used diathermy transurethral three times and transvesically once in 4 cases regarded as inoperable. With our modern instruments and electrodes it is generally possible under spinal or caudal anesthesia to accomplish all that is desired trans-

urethrally. Where there is uncontrollable bleeding or the growth is too large, we do it transvesically. Deep x-ray therapy precedes and follows diathermy. We do not permit the Roentgenologist to dictate to us, thus admitting our fear of uncontrolled treatment. I must admit that rarely have we obtained 5 year cures. We have four patients; two women living over 10 years, both were pronounced inoperable by men of repute, and incidentally their families were told that they would not live 6 months. Both responded to x-ray therapy; one received diathermy transvesically and one transurethrally. The latter has a recurrence about every 6 to 9 months, which is controlled in the office. The other has had no recurrence, and clinically she was far more hopeless. Two men, living 6 and 8 years, respectively, with growths extending along the right sphincteric margin and posteriorly for one inch, are symptom free, but cystoscopically all is not well. Both were treated transurethrally. It is quite probable that if we had undertaken radical surgery in these cases they would not be alive today. Our thought is, "follow the golden rule and pray for luck."

Conclusions

1. Diathermy is of great value to the urologist.
2. Medical diathermy, or thermopenetration, is the treatment of choice in epididymitis, prostatitis, and seminal vesiculitis, and of value in endocervicitis.
3. Surgical diathermy is the best treatment at present in all precancerous lesions of the bladder and urethra and external genitalia. In combination with x-ray therapy it gives about as satisfactory results as any other proposed method in the management of malignant neoplasms.
4. Transurethral diathermic removal of obstructions in and about the vesical neck has a definite field of usefulness in selected cases. It may in the future prove an excellent prophylactic measure in prostatism.

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Discussion

Dr. George R. Livermore (Memphis, Tenn.): Physical therapy in the treatment of chronic prostatitis is a distinct help and there is no question of its value. The great objection to it as far as I can see is the length of time that it takes. I have found a great deal of use for diathermy in various types of inflammatory conditions. Some years ago I brought out the use of the high frequency current in strictures of the urethra, thus doing away with the intense cicatrization of that stricture. If an ordinary electrode is passed up the urethra to the end of the strictures and then fulgurated on one side, it is remarkable how you can dilate that stricture afterwards and how it stays dilated.

Dr. A. E. Jones (closing): You will remember that I said that in the treatment of chronic prostatitis and vesiculitis, 28 per cent showed improvement, although the urine was not free of pus at the time the treatments were discontinued. You are probably asking why I did not continue. Those patients got away from us because they became discouraged. We tried to accurately report what our records showed, and that is why I recorded those 28 cases.

As far as the gonococcus is concerned and its susceptibility to heat, you all know that ever since Neisser discovered the gonococcus, one of the first things we knew about it was its susceptibility to heat. Within the last few years susceptibility to heat in tissues has been disproved and acute gonorrhea cannot be cured with diathermy. However, the virulence of the gonococcus seemed to be especially reduced by diathermy in connection with mixed infection. Whether diathermy raises the resistance, or increases the defensive forces or not is still an interesting speculation.

I want to say a few words about the treatment of epididymitis by diathermy. Haines says that it is by far the best method. I can't agree with him. For older individuals who cannot stand protein shock, diathermy is very excellent and it is perhaps the best method, but for younger individuals, and especially in gonorrheal epididymitis, I think that diathermy could very well be combined with protein shock treatment. The only contraindications that we have found to protein shock are old age, heart pathology and tuberculosis.

Dr. Pugh cited a case in which he failed to diagnose a cyst of the kidney except upon exploratory nephrotomy. We have been having very good diagnostic success by intravenous urography. The successive films show an increased concentration of iodid in the cysts, so that we were able to diagnose, especially a solitary cyst of the kidney, every case in the last year by the use of intravenous urography.

I agree with Dr. Pugh that cystoscopic diathermic treatment of carcinoma of the bladder, is poor surgery and should be treated openly, because it is impossible to tell from the morphologic characteristics of the specimen, the malignancy or the benignancy of the tumor. I have seen tumors of the bladder, classified by very competent pathologists as papillary tumors, assume an extremely malignant course afterwards and con-

versely those with mitotic figures run a benign course. The only real method of treatment is by open operation, and the man who attempts to treat these bladder tumors through the cystoscope may have a hard time defending himself later if the tumor proves to be malignant.

Dr. Winfield Scott Pugh (New York): It is a mistake to think that one particular method should be applied to every urologic condition. However, for acute infectious kidneys, acute prostatitis, or acute seminal vesiculitis, diathermy has been found very excellent. In epididymitis following prostatectomy and in some cases of chronic seminal vesiculitis, we seem to have gotten good results with diathermy. Diathermy appears to be not as effi-

cient in acute Neisserian infections in the male as it is in the acute cervicis of the female.

Electrosurgery is not a panacea for all stones in the kidneys, but it is a method that reduces hemorrhage and shock. The results so far have been quite satisfactory.

We also do not regard diathermy as a panacea in cancer of the bladder nor in prostatitis. There is a certain group of cases in which it is extremely helpful, and in which it should always be called upon as an aid.

I agree with Dr. Jones that it is highly advisable in all cancers of the bladder to do an open operation. The judgment of conservative surgeons uphold this view.

RATIONALIZATION OF PHYSICAL MEDICINE ON A BASIS OF BIOCHEMICAL AND BIOPHYSICAL EFFECTS

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Natural medicine or, as we now call it, physical medicine, to distinguish it from pharmacal and psychic medicine, has an ancient and honorable history as an integral part of medical practice.

The adjective physical, as well as the noun physician, is derived from a Greek root referring to nature or natural, because the ancients employed therapeutically the various forces manifested by nature such as sunshine, hot sand, hot mineral springs, the steam from hot springs, sea and river bathing, cold douches, climate and altitude to which were added exercise and rest, diet and massage.

The art of natural medicine therefore preceded the science by many centuries. It was not until knowledge became truly scientific and facts were accumulated through the invention of various devices for administering and measuring the various forms of energy that natural medicine profited by rationalizing the various procedures and developing exact methods of technic.

Preliminary to classification we will adopt and explain certain definitions for a common ground of understanding.

Therapeutics. Therapeutics is the science of the application of energy to a living organism for the purpose of preventing, ameliorating, curing, or modifying abnormal structure and function.

Therapy. Therapy is the art of applying energy to a living organism for the purpose of

preventing, ameliorating, curing or modifying abnormal structure and function. *Therapy is applied therapeutics.*

The Basis of Therapy. According to Osborn,* "The evolution of life may be written in terms of visible energy as it has long been written in terms of visible form. All visible tissues, organs, and structures are seen to be more or less simple or elaborate agents of the different modes of energy. One after another, special groups of tissues and organs are created and coordinated — organs for the capture of energy from the inorganic environment and from the life environment, organs for the storage of energy, organs for the transformation of energy from the potential state into states of motion and heat.

Other agents of control are evolved to bring about harmonious balance between the various organs and tissues in which energy is released, hastened or accelerated, slowed down or retarded or actually arrested or inhibited."

Again he says, (locus cit. p. 21.) "In each organism the phenomena of life represent the action, reaction and interaction of four complexes of physico-chemical energy, namely those of (1) the Inorganic Environment, (2) the development Organism (protoplasm and body chromatin), (3) the germ or heredity-chromatin, (4) the Life Environment. Upon

* The Origin and Evolution of Life by Henry Fairfield Osborn. Charles Scribner's Sons, N. Y., 1918. P. 17.

the resultant actions, reactions and interactions of potential and kinetic energy in each organism. Selection is constantly operating wherever there is competition with corresponding actions, reactions and interactions of other organisms."

Structure and function therefore can be understood only in the light of energy, and it would seem rational, as it has been found empirically correct, to employ selected forms of energy for the restoration of abnormal structure and function to normality. We are led therefore to a study of how energy is produced, how it may be applied, and in what form it is absorbed by the living body, the bioreactions thus engendered and their further control.

How Therapy Applies Energy. Therapy applies energy in its two forms, potential and kinetic. Potential energy is applied in two forms, viz. —

(1) Chemical energy from organic, (animal and vegetable sources) and inorganic (mineral) sources. If the substances are used as drugs, the treatment is called *Pharmacotherapy*. If the substances are those usually used as food, the treatment is called *Dietotherapy*.

(2) Psychic energy or the effect of the mind upon material and mental conditions when used in treatment is called *Psychotherapy*. Kinetic energy is applied in five forms, viz. —

(1) Electrical, (2) Electromagnetic, (3) Radiant, (4) Thermal, (5) Mechanical. When these forms of energy are used for treatment either severally or in combination it is called *Physiotherapy** or Physical Therapy.

Physiotherapeutics. Physiotherapeutics is the science of the application of kinetic energy to a living organism for the purpose of preventing, ameliorating, curing or modifying abnormal structure and function. Physiotherapeutics considers therefore the following:—

(1) The laws (physics) of kinetic energy utilized in treatment.

(2) The forms in which kinetic energy is available for treatment.

(3) The source, apparatus, appliances and accessories made use of in applying kinetic energy for treatment.

(4) The technic of applying kinetic energy for treatment.

(5) *The form of energy into which the applied kinetic energy is converted and absorbed by the living organism.*

(6) The bioreactions engendered by the absorbed energy:—(a) local, (b) referred or reflex, (c) constitutional and (e) psychic.

(7) The indications and contraindications existing for the production of this absorbed energy and hence the selection or rejection of forms of kinetic energy for treatment.

(8) Adjuvant, modifying, reinforcing or opposing forms of applied kinetic energy.

(9) Estimation of dosage and decision as to frequency of application.

(10) Untoward or harmful effects and their avoidance, prevention, or neutralization.

Physiotherapy Defined. Physiotherapy is the art of applying kinetic energy to a living organism for the purpose of preventing, ameliorating, curing or modifying abnormal structure and function.

The practice of physiotherapy considers the selection of the form of energy which is to be the remedy required to produce the desired bioreaction; the selection and application of the correct form of kinetic energy to be applied for this purpose; the management of apparatus, and materials incident to the treatment; and the management, preparation and treatment of the patient together with supervision during and after treatments.

Attention is especially invited to subject (5) above. With the exception of mechanical energy the other forms of kinetic energy are not absorbed in the form in which they are applied. As only that form which is absorbed can act as the remedy it cannot be too strongly emphasized that the remedy is not the apparatus, the appliance used, the technic, nor even the form of kinetic energy applied.

The writer emphasizes this because the general failure of those writing upon this subject, from the Council of Physical Therapy of the American Medical Association down, to appreciate this very important distinction has led to a confusion in nomenclature, the employment of silly and nonscientific terms which can neither be explained nor classified. Indeed some of the attempts at classification based on these outlandish terms would be laughable if they were not lamentable. Language of scientific men is not given, as Talleyrand said, "to conceal our thoughts,"

* The word "physiotherapy" is etymologically correct and harmonizes with pharmacotherapy and psychotherapy. It is a term in good standing abroad and should enjoy the approval and acceptance of those who prefer the nicety of correct diction to slovenly bastard terms.

but to convey thoughts accurately from one mind to another.

When the five forms of kinetic energy mentioned above are applied to the living body they are absorbed as mechanical, thermal or chemical energy, or psychic energy, or combinations of these. Physiotherapy therefore uses biochemical, biothermal or biomechanical reactions as the remedy. Psychic reactions arise from these. Reduced to its simplest terms physiotherapy is either a chemical, or a thermal, or a mechanical treatment, or a combination of these with attendant psychic reactions.

The Modalities of Physiotherapy. From what has just been said the modalities of physiotherapy are limited to thermotherapy, mechanotherapy, certain forms of chemotherapy, and their various combinations.

Thermotherapy

The Modalities of Thermotherapy. Thermotherapy may be administered in four different ways depending upon the manner in which heat is engendered in the body. These are *conductive* heat, *convection* heat, *convulsive* heat and retained or *autogenous* heat. (Note: Artificial fever induced by drugs or infectious organisms is an example of chemothermotherapy from potential energy.)

Conductive Thermotherapy Defined. Conductive thermotherapy is that modality of physiotherapy in which there is an attempt to raise or lower the temperature of all or a part of the body with reference to normal temperature by contact directly with solid, liquid, or gaseous substances having a higher or lower temperature than the body. These substances may be wet or dry, and the treatment may be kinetic or static. The various forms of technic for conductive thermotherapy are as follows:—

Wet Conductive Heat

Static Treatments

Hot or cold immersion water bath.
Hot or cold allover pack (sheet bath).
Hot or cold compresses and poultices.
Hot or cold drinks.
Hot or cold retained enemas.
Freezing mixtures, e.g. ice and salt.
Hot mud (fango) baths.

Kinetic Treatments

Hot or cold immersion water bath with friction; viz., (a) manual, (b) natural effervescent water from springs, (c) artificial effervescent water, (d) bubble baths and (e) the foam and bubble bath.
Whirlpool water baths.
Showers, douches, and needle spray baths.
Ice rubs, hot and cold mitten rubs.
Hot and cold sheet packs with friction.
Drip sheet with friction.
Continuous colonic irrigation with hot or cold water.
Swimming or wading in fresh or salt, still or moving water.

Dry Conductive Heat

Static Treatments

Hot blanket packs.
Hot sand or bran baths.
Hot water bag or bottle.
Electric pad or blanket.
Hot bricks or salt bags.
Ice cap, ice bag, or Leiter's coil.
Hot paraffin immersion baths.
Actual cautery.
Carbon dioxide snow.
Ethyl chloride freezing spray.
Evaporation of ether or alcohol or water.

Kinetic Treatments

Hot flat iron.
Hot salt rub.

Secondary biophysical and biochemical effects are obtained by combinations of the above methods as for example, the radioactive, or electrolytic, or cardiovascular tonic baths or the Scotch douche, etc. Most of the above procedures are usually treated under the caption of hydrotherapy and balneology.

Convective Thermotherapy. Convective thermotherapy is that modality of physiotherapy in which there is an attempt to raise or lower the temperature of all or a part of the body with reference to the normal temperature by means of exposure to air which has a higher or lower temperature than the body. The air may be still or moving, humid or dry, and the change in temperature of the body is effected by convection or radiation depending upon the temperature of the air.

Humid Convective Heat

Static Treatments

Hot air containing steam in closed cabinets or rooms (the so-called Russian bath).

Kinetic Treatments

Natural ventilation plus fans or punkahs.
Artificial ventilation including conditioned air.
Hot moist air douches.
Weathering, that is, exposure to open currents of humid air as in climato-therapy.

Dry Convective Heat

Static Treatments

Hot dry air in closed cabinets or rooms or in a sleeping bag or ovens (the so-called Turkish bath).
Cold dry air in closed refrigerated rooms or cabinets.

Kinetic Treatments

Natural ventilation in arid or desert regions plus fans and punkahs.
Hot or cold dry air douches.
Weathering, that is, exposure to open currents of dry hot or cold air as in climato-therapy.

Convulsive Thermotherapy. Convulsive thermotherapy is that modality of physiotherapy in which the temperature of all or a part of the body is raised above the normal by the application of electric, electromagnetic, electrostatic or mechanical energy and the treatments are called, electrothermy, radiothermy, photothermy and mechanothermy.

Electrothermy. Electrothermy is that modality of physiotherapy where the tis-

sues of all or a part of the body are raised in temperature above the normal by their resistance to the passage of electrical currents of high potential, oscillating at frequencies not less than ten kilocycles per second. Oscillations below this limit of frequency produce very unpleasant mechanical and sensory effects. Since every oscillating current produces an oscillating electromagnetic field around its path, part of the phenomena observed is due to the production of these fields about the conducting tissues and their absorption by the neighboring tissues.

The variations in technic of electrotherapy are as follows:—

Diathermy. (Also called medical diathermy). Here the temperature of all or a part of the body is raised above the normal but not beyond that which the tissues or body can stand and survive. The patient is in shunt with the d'Arsonval solenoid of the high frequency circuit and is traversed by an electrical current having damped oscillations of high potential and high frequency. The heating effect takes place from the area of the skin in contact with the electrodes inward and is due to the (ohmic) resistance of the tissues to the passage of the current, as well as (in part) to the absorption of the electromagnetic field accompanying the current through the conducting paths of the body.

Endotherapy. Method of deKraft. The current is derived from a deKraft resonator or autotransformer connected with a Tesla transformer activated by a hyperstatic transformer which last is but a d'Arsonval coil attached to the outer armatures of very large Leyden jar condensers attached to a Holtz influence machine. The patient must be suitably insulated, usually upon the condenser platform, and is connected with one terminal of the Tesla coil. A brush discharge of very high potential and high frequency oscillations but of small volume is administered to any portion of the body by a suitable electrode of special design connected with the terminal of the deKraft resonator.

The same treatment may be given from an Oudin resonator using a Titus effluve electrode and connecting the patient with the other terminal of the d'Arsonval solenoid. Its thermal effects are not so powerful or penetrating.

In either case the general temperature of the body is raised above the normal. The

treatment is administered to the bare skin surface and not through clothing.

Electrocoagulation. (Also called surgical diathermy and surgical endotherapy). The same technic is used as with diathermy, except that one or both electrodes are reduced to needle points so that the current is concentrated to such an intensity as to heat to destruction the tissues in contact. The technic may be monodal or binodal according to whether the operating electrode is single connected with one terminal and the circuit is completed by a large inactive electrode connected with the other terminal of the d'Arsonval solenoid, or whether both electrodes are operating electrodes and are connected with the opposite terminals of the d'Arsonval solenoid.

Electrodesiccation. The tissues are dehydrated and raised in temperature to the charring point by a needle electrode connected with the terminal of an Oudin resonator (high potential transformer) which delivers a very high potential high frequency oscillating current of small volume. The patient may be insulated upon a condenser platform or not. The effect is intensified if the patient be grounded.

Acusection. Division of tissues bloodlessly as with a knife, by means of a needle electrode transmitting an undamped, sustained, oscillating current of high frequency and potential preferably derived from a thermionic oscillating tube, or a damped oscillating current from a spark gap, condenser-solenoid circuit of the d'Arsonval type. The inactive electrode is placed elsewhere on the body.

Radiotherapy. Radiotherapy is the heating of all or a part of the body by electrical currents created inductively in the tissues by subjecting them to high potential high frequency oscillating electromagnetic or electrostatic fields having a minimum frequency of ten kilocycles.

Autoinduction. (Called autoconduction by d'Arsonval, its discoverer). The patient or limb is placed within the oscillating electromagnetic field in a large solenoid which is in shunt with the solenoid of a d'Arsonval circuit. The oscillations are damped and the effect is concentrated in the axis of the treatment solenoid. The patient is not in electrical connection with the circuit. He is heated by the oscillating currents induced in

his body by the electromagnetic oscillations (a form of hysteresis).

Autocondensation. 1. The method of Nagelschmidt. The patient is heated by currents induced by being placed in an electrostatic field between two plate condensers in shunt with the d'Arsonval solenoid.

2. The method of Apostoli in which the patient lies upon a mattress-shaped condenser connected with one terminal and is made the other armature of the condenser by being connected with the other terminal of the d'Arsonval solenoid.

3. Method of deKraft. The patient sits upon a chair-shaped condenser or condenser pad connected with one terminal of the d'Arsonval coil and places his feet on a stool condenser connected with the other terminal.

4. Method of Schittenhelm. The patient lies with shoulders upon one condenser and the buttocks upon the other which are activated by the current in shunt with the d'Arsonval coil.

5. Method of Strong. The condenser is fashioned into a glass vacuum or non-vacuum instrument to be held in the hand of the operator or inserted for orificial treatments. The power is derived from the terminal of an Oudin or deKraft resonator. The best effects are obtained with the patient grounded, or insulated upon a platform condenser as the condition indicates.

Note. The above treatments are all obtained by damped oscillations of high frequency and high potential though the volume (amperage) varies considerably. As the condenser-spark gap-inductance high frequency circuits are replaced by oscillating tube circuits which will afford higher potential currents, the above methods will be superseded by.

6. Radiotherapy proper. (This is also called short wave therapy). The patient is submitted to a high frequency oscillating electrostatic field of force between two plate condensers activated by oscillating radio tubes. He is not in electrical connection with the circuit but is heated by oscillating currents in the tissues induced by the oscillating electrostatic fields. The whole body may be heated as in fever therapy, (method of Bierman and Carpenter and Schliephake) or a part. (Method of Schereschewsky.) Localization of the heating intensity is obtained by a localizing supernumerary condenser by the method of Bierman.

Note. There is no contraindication to the employment of electromagnetic field of force produced by the radio tube circuit and a large treatment solenoid in the same manner as for autoinduction, (vide supra). Great heat is obtainable this way as observed with Northrup's radio furnace for melting metals constructed on this plan.

Phototherapy. Phototherapy is that modality of physiotherapy in which the temperature of all or a part of the body is raised above the normal by the use of radiant energy from heated sources. The effective heating energy lies in the electromagnetic spectrum between wavelengths 500 millimicrons and 1.4 microns, ($\lambda 500 \text{ m}\mu$. — $\lambda 1.4 \mu$.)^{*} This radiant energy when absorbed is converted into heat. There are two variations of phototherapy viz., immediate (unfiltered) and mediate (filtered).

1. Immediately phototherapy employs either (a) obscure radiation exclusively in the infrared region of the electromagnetic spectrum, which is emitted by hot black bodies or (b) incandescent radiation containing a mixture of luminous and obscure (infrared) radiation. The former (a) is not to be recommended as most of the so-called infrared generators radiate a preponderance of their energy in wave lengths which do not penetrate through the skin and are therefore inefficient photothermal agents. The preferred sources of radiant energy for phototherapy are incandescent carbon and tungsten filament electric lamps with incandescent metallic coils as a second choice.

2. Mediate phototherapy employs incandescent substances radiating at a high temperature as the sun or carbon electric arc lamps from which the chemical rays are removed by appropriate filters.

Mechanotherapy. Mechanotherapy is that modality of physiotherapy in which an attempt is made to raise the temperature of all or a part of the body by means of hyperemia and oxidation from motion. Thus we have (a) heating of tissues by mechanical vibration and oscillation including especially supersonic frequencies, (b) voluntary muscular motion, (c) Bier's passive hyperemia and (d) various procedures as friction, slapping, whipping, and needle spray baths.

Autotherapy. Autotherapy is that modality of physiotherapy in which the nat-

^{*} For the justification of the use of $\text{m}\mu$. instead of $\mu\mu$. for the abbreviation of millimicrons see A. Prost, by H. S. Uhler, *Science*, 65:232-233, 1927.

ural heat of the body (sometimes increased by various procedures) is intentionally prevented from escaping by surrounding the body by an environment which is impervious to heat loss. Autothermy is usually a feature of other thermotherapeutic measures. Fever temperature may be caused and maintained.

Chemotherapy (As Used in Physiotherapy)

Chemotherapy. When some forms of kinetic energy are absorbed they are converted into chemical energy in the tissue cells. The chemical changes thus brought about produce local or reflex or constitutional effects depending upon the nature of the energy absorbed and the absorbing substance. The forms of energy employed are electrolytic currents, radioactive energy, gaseous ions and electromagnetic radiation of special wavelengths from photochemical sources or x-ray tubes.

Electrolysis. Electrolysis is that form of physiotherapy in which electrolytic currents are made to pass through the body and exert polar (anodal or cathodal) or interpolar electrolytic effects which are chemical in character. The chemical effects of anode or cathode may be selectively obtained to any degree from zero to destruction by chemical cauterization.

Electromedication. Electromedication is the transcutaneous or transmucosal introduction of certain medicinal substances in the ionic state from the appropriate pole by an electrolytic current. The method has also been called iontophoresis. (Note: It is not ionization, which is an entirely different phenomenon, and not a method of treatment.)

Radioactive Therapy. Radioactive therapy (Curietherapy) is the employment of radioactive energy, alpha, beta and gamma radiation as given off from disintegrating radioactive elements for medicinal (pharmacal) effects or for surgical (chemical) effects.

When brought in contact with tissues local chemical effects are obtained with alpha, beta and gamma rays together or (by screening) with beta and gamma rays only or (by further screening) with only gamma rays. (Note: Alpha rays are showers of helium ions, beta rays are showers of free electrons, and gamma rays are electromagnetic radiations.)

When the radioactive gas radon is used it may be breathed, swallowed in water, or injected, as are other chemicals. Soluble salts of other radioactive solid elements are similarly employed.

Note. Free electrons called Lenard Rays have lately been produced in large numbers and at a high velocity by Coolidge. (General Electric Laboratories). Their employment for remedial purposes has not been considered as their concentration and velocity are promptly lethal to living tissues.

Aerionic Therapy. Aerionic therapy is the use by inhalation of atmospheric air whose gases have been ionized by means of a special electrical apparatus (Dessauer) or from air in certain regions known to contain ions of one sign or the other in preponderance.

Photochemical Therapy. (Photochemistry). Photochemistry is that modality of physiotherapy which employs radiant energy between wave lengths of 500 millimicrons and 240 millimicrons which when absorbed by the skin causes chemical changes producing local, reflex, or constitutional effects. The chemical change effected depends upon the absorbing substance and the wavelength of energy absorbed. A special form of photochemistry called photosensitization is obtained by introducing in any way certain photodynamic substances into the body which when floating in the peripheral blood and exposed to luminous wave lengths of radiant energy become electrochemically active, causing a form of allergy.

Grenz Ray Therapy. Grenz (or border line) x-ray therapy is that modality of physiotherapy where superficial cutaneous chemical changes are obtained by electromagnetic radiation in the region of wavelength 0.2 millimicrons (2 Angström units).

Röntgen or X-Ray Therapy. Röntgen or x-ray therapy is that modality of physiotherapy where chemical changes are caused by the absorption of electromagnetic radiation which lies in the spectrum between wavelengths of 2 and 0.005 Angström units. These may be applied directly or filtered through various substances as brass, aluminum, leather, etc., to remove (soft) long wave x-rays.

Mechanotherapy

Mechanotherapy. Mechanotherapy is the forcible mobilization or immobilization of living tissues. It has three modalities — voluntary motion, involuntary motion, and immobilization.

Voluntary Mechanotherapy. Voluntary mechanotherapy (popularly called active exercise) is the production of self-controlled

movements of voluntary muscles together with attached ligaments, tendons, fascia and bones either independently or at the word of command for specific therapeutic purposes: It includes:

1. Occupational therapy. This consists of movements of groups of muscles and joints by engaging in handicrafts, machine control, or other occupation for the specific purpose of reeducating muscles, stretching tissues, restoring tone and nutrition, and improving co-ordination. It has also a contributing psychic value.

2. Correctional exercise. This consists of directed participation in games and sports, gymnastics, including hydrogymnastics, athletic and military drills, swimming and bathing in still or moving fresh or salt water, solo or ensemble dancing, and singing and breathing exercises.

Involuntary Mechanotherapy. Involuntary mechanotherapy (popularly but erroneously called passive exercise) is the active motion of cells, tissues, organs, limbs and their contained fluids by the application of mechanical force to the body without voluntary effort upon the part of the patient. We distinguish, manual, instrumental, electrical, electromagnetic, barometric, hydrostatic, and gravitational methods.

1. Manual mechanotherapy. (Massage.) By means of the hands of the operator the tissues are stroked, compressed, percussed or shaken, and fluid contents displaced.

2. Manual and instrumental mechanotherapy.

(a) Conservative — Flexion, extension, rotation, circumduction, reduction of dislocations and subluxations, setting of fractures, and refraction by lenses. (b) Traumatic (Surgical) — Incision, puncture, amputation, excision, scraping, drilling, plugging, fixation, torsion, dilatation, expression, compression, traction, morcellation, transplantation of tissues, replacement of organs and larvae (Morcellation) by maggots.

3. Instrumental mechanotherapy.

(a) Mechanotherapy movements by self-operated or motor powered apparatus such as those of Zander and of Riesland.

(b) Tissue oscillation by motor driven vibrators using slow or rapid vibration.

(c) Supersonic vibrations of the tissues from high frequency electromagnetic currents transmitted through liquid or solid media.

4. Electromechanotherapy. Here the tissues are caused to contract involuntarily by means of electrical currents having rhythmic or timed periods of changing intensity.

(a) Low tension electric currents.

The electrolytic or direct current. { Interrupted
Surging.
Interrupted
and surging.

The alternating and sinusoidal currents. { Constant.
Continuous.
Surging.
Interrupted.

(b) Combined direct and faradic currents. Method of deWatteville. Surged, method of Tousey.

(c) High tension electric currents.

High potential direct current from influence electrical (electrostatic) machines. { Surging charge
(Morton wave).
Mobile sparks.
Brush discharge.
Electrostatic induced. (Current of Morton.)
Continuous.
Interrupted.
Surging.

Faradic or induced current.

Baromechanotherapy. This modality employs atmospheric pressure for herapeutic purposes.

1. Positive atmospheric pressure, used by inflation, compression by compressed air chambers, pulmonary collapse.

2. Negative atmospheric pressure used by cupping, negative pressure chambers, suction, rectal intubation for meteorism, altitude.

3. Alternating or varying atmospheric pressure by artificial respiration, manual or by apparatus as the Drinker or other such contrivance, pulmotors, and pneumovibrators.

Hydromechanotherapy. Hydraulic pressure is used for therapeutic purposes as follows:

1. Positive hydraulic pressure used as gavage, lavage, irrigation and douching, imbibition, enteroclysis, hypodermoclysis, veniclysis, transfusion, vascular occlusion by ligation or injection.

2. Negative hydraulic pressure used as catheterization, paracentesis, venisection (phlebotomy) puncture, drainage of wounds, drainage of hollow organs, application of leeches, multiple incisions, tourniquets.

Mechanotherapy by Gravity. This modality employs posture, suspension, counterweighting and support by waterbeds, or flotation in water.

Mechanotherapy by Magnetic Attraction. This modality employs electromagnets for the

extraction of foreign metallic bodies from the flesh (especially the eyeball).

Mechanotherapy by Immobilization. This modality compels the fixation of otherwise mobile tissues, organs or limbs to compel rest, overcome opposing muscular force, avoid trauma, give support, and favor union. The vari-

ous procedures come almost entirely within the domain of surgery and comprise bandaging, strapping, suturing, wiring, pegging, splinting, bracing, the application of casts, extension, and various orthopedic devices and operations.

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NEW CONCEPTIONS OF ARTHRITIS AND THEIR RELATION TO PHYSICAL THERAPY *

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Physical therapy constitutes one of the most important methods in the management of arthritis. Yet it is erroneous to assume that it alone suffices to solve the therapeutic problems of arthritis. It is generally agreed that the patho-anatomical findings, the etiological discoveries, and the study of allergy have not clarified the problem of arthritis because they have ignored the most important factor, i.e. the body tissues and their rôle in the production of the clinical picture.

Medicine is an eminently practical, utilitarian science. Whatever we do in the line of research ultimately is expected to be of some value not only in the understanding of the pathological process but for its final goal—therapy. The last question will and should always be: How can we hope to use the discovery for the alleviation of human ailments? What value has it in our present problem in the prevention and cure of arthritis?

Beginning with the patho-anatomical classification into a proliferating and degenerative form, as suggested by Nichols and Richardson, I fail to see its value from the standpoint of therapy. We have hundred of thousands of cases of arthritis in this country. They differ vastly in their clinical pictures, in fact there are very few cases which look alike. Even Nichols and Richardson state that every case of the proliferative type shows degenerative features and vice versa. How then can we group all these cases varying in age, stage, location, intensity, progress, clinical picture, and outcome under these two headings?

The classification of Nichols and Richardson has been somewhat modified by Cecil and Archer, who divide the proliferative group into chronic infectious arthritis, specific arthritis (known bacteria) and arthritis deformans, and the degenerative form into arthritis of the menopause, degenerative monoarticular and senile varieties.

The American Committee for the Study of Arthritis divides the cases in the atrophic (proliferative) and the hypertrophic (osteoarthritis, degenerative) forms.

Interesting as the divisions of Nichols and Richardson and of the American Committee are from a purely academic standpoint, they have no clinical value except for prognostic purposes. They indicate for instance that if the joint tissue, the cartilage is destroyed, no one need expect a restitution.

Of far greater significance for the treatment are the etiological researches and findings. If we can establish the main causative factor, the type of active agent, we may be able to direct treatments according to definite indications. Whenever we can satisfy these requirements, be it by removing the infectious focus, (infected teeth or tonsils) or by combating the micro-organism as in the gonorrheal and syphilitic forms, or by strengthening the defense of the organism in its fight against the tubercle bacillus, etc., the problem will be solved.

When, however, all this is impossible, we are confronted with great difficulties if we follow the classical road in the management of arthritis. In the instances mentioned we have to deal practically with only one factor,

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 14, 1933.

the infecting agent, and if it is disposed of, not much is left to be done. If, on the other hand, we were not able to eliminate the agent and relieve the body of its burden, then we can not speak of *one* cause. In fact, there never was a question of one cause but only of the most important one. With the impossibility of eliminating the causative micro-organism, it has now become only one of the many factors correlated in the symptom complex we call arthritis. Among these factors the most outstanding, the deciding one is the body of the individual patient—his constitution, his reactions.

In nearly every article concerning this problem we find the statement that the clinical picture is often identical in spite of different causative agents, and that the same agents may produce different clinical pictures.

This implies that the clinical picture is determined by the reaction which the body sets up against an irritation, and that the etiological factor is of but secondary importance. This alone can explain the many causes to which arthritis has been correctly attributed, such as infections, infectious toxins, endogenous, organic and inorganic poisons, products of metabolism, allergy, and that rheumatic symptoms have been observed in typhoid fever, pneumonia, dysentery, scarlatina, etc. This proves that a patient shows signs of arthritis because his joints react by inflammation to some kind of irritation. Arthritis, no matter in what form, is not a disease *per se*, but an expression of reaction by an inflammatory process. This fact holds true in nearly the entire field of medicine, particularly in those types of cases which are classified as infectious conditions.

In the physical sciences we have learned to appreciate that the conception of cause and effect is misleading. There are no causes but conditions leading to other conditions. There is never one factor which counts but an infinite number of them, not all of the same importance and bearing, but all of them correlated. We may for the purpose of teaching or discussions disregard all the minor factors, but they exist just the same.

When we speak of arthritis everyone of us has a special case in mind.

Thousands of able men are working on the problem of arthritis and if there are so many discrepancies in the results of their investigations we may find the reason in the wrong

evaluation of the most important factor in the clinical picture, the human body.

If we can destroy the provocative agent in the body in time, before much damage is done, the case will be cured. If we can kill the gonococcus by hyperthermy we often do not need to give much local treatment. But we know that some strains of the gonococcus are heat resistant, unable to be eliminated by physical therapy, hence we must then pay attention to the control of the reaction of the body tissue. Accordingly I group my cases in those in which the inciting factor has been found, removed, or in some way eliminated, and in those in which these factors have either not been determined or in which the efforts to eliminate them were unsuccessful.

The problem is proportionally simple. What is left for us is to restore the function. If the damage to the joint tissue was not too severe we are able to remove the swelling by massage, to soften adhesions and restore motility by heat, particularly diathermy, and reestablish contractility and tonicity of the muscles by sinusoidal stimulation. Many other methods may also be useful. Hot packs or electric cabinet baths to stimulate elimination, sulphur baths, gymnastics, hydiatic procedures to help build up the body—all these are of great value. We do not need to be concerned here about exacerbations or relapses because the original cause has been removed.

The situation is far more serious if we have to deal with a case which belongs to the second group, that is, if we have not been successful in coping with the irritating factor. If the joint affection is of tuberculous nature we can strengthen the defense of the organism by sunlight treatments. The adjuvant treatment consists merely in rest, to avoid harmful local irritation.

The problem is quite different, and from the standpoint of the physiotherapist very serious, if we have to deal with a streptococcus infection. I may mention in this connection that in an article which has been accepted for publication in the *N. Y. State Journal of Medicine*,* I have suggested an acetyl-salicylic acid tablet test for diagnostic and therapeutic purposes. I have pointed out that we may by the positive test of the relief of pain immediately following the administration of this tablet, exclude all infections of a tubercular, gonorrheal, or syphilitic

* September 15, 1933.

nature. I have been practicing this method for many years successfully and found out only recently that such a test has been used in Europe for diagnostic purposes, though not as a guide for therapy. Still, it is obvious that no result can be expected from the extraction of a tooth or a tonsillectomy when the test is negative.

In streptococcus infections the stage of the inflammation is of great importance. It is well known that an acute arthritis can become greatly aggravated by removal of the tonsils or extraction of infected teeth. It is often inadvisable to interfere with a local infection. Shall we then leave it to nature to do its worst or rely on purely palliative procedures such as immobilization or traction?

Many physicians, following the recommendations of August Bier, have used protein shock therapy with the intention of stimulating the inflammatory process to its utmost. This method may in a few cases of acute gonorrheal arthritis be helpful by creating high fever and thus destroy the gonococcus. In other instances it is only harmful by increasing the inflammation, the edema, the hypertrophy of connective tissue still more and promoting adhesions.

The idea of increasing the local reaction as a routine procedure is based on wrong premises. It is generally accepted as contraindication to use diathermy in cases of acute inflammations. This rule is not directed against diathermy *per se* but against its heat producing quality. We may with equal justification establish the same contraindication against any other heat procedure which is not in itself curative by destroying the micro-organism.

The object of our treatment must be to reduce the local reaction to the most favorable degree, and for this physical therapy procedures alone can be used. By applying cold applications we can reduce the local inflammation and all its symptoms, particularly pain. We can then remove the swelling by massage, relieve the pain so that passive motions may be possible. By reducing and shortening the inflammatory process we may hope to prevent the disastrous consequences which a long inflammatory process of great intensity and long duration has on the function.

The problem is different when we have to deal with one of those unfortunate cases in

which the kind of infection can not be determined and eliminated, which do not show any symptoms of an acute disease, but which slowly but gradually go from bad to worse. They constitute the great problem in the treatment of rheumatic diseases and the failures of our efforts to cure them by physical therapy has created a prejudice among many physicians against these methods.

If physical therapists deserve a blame, it is not because their methods are unable to cure these patients but because they are using them with too little discrimination. In fact all methods, medicinal as well as physical, seem to fail us here. We may by vaccines, injections of sulphur, foreign proteins, milk, try to combat the micro-organisms but the results are in too many cases disappointing.

Routine treatments, particularly the indiscriminate use of heat, is very often harmful as the resulting hyperemia draws the toxins and bacteria into the affected joints and aggravates the condition. Physicians in Europe very frequently speak of the "bath reaction" (Baederreaktion), which means an aggravation of symptoms a few days after the beginning of a cure. This has been looked upon as a favorable sign, as an indication that the treatments were taking effect. In reality it may be due to an increase in the local reaction by the activation of the pathological process. To me it has always been a proof that the focus is still active and I have found it wise to discontinue the treatment. Such aggravations have influenced many clinicians against physical therapy, while they only show that in this type of case physical therapy in the form of heat applications should not be employed. I prefer, in these cases, to abstain from heat treatments and to rely exclusively on wet applications, massage, and electrical stimulation. We can in this way successfully combat the local reaction, improve the local circulation, hasten absorption, and keep the muscles in good condition. The results which I have thus obtained illustrate my contention that our object must be to assist the body. This does not mean, however, that we must necessarily whip it up to greater efforts, but that we should try to relieve the strain on the system.

For this purpose physical therapy is the method of choice. By no other method can we reduce the inflammatory process. All other procedures and treatments stimulate it.

Cold and wet compresses and massage are of the greatest value.

Conclusions

Classifications must have a purpose. Those from a patho-anatomical standpoint have only a purely academic and prognostic value. By laying stress on the structural changes in the joint tissues they indicate the chances and degree of functional recovery.

Grouping according to etiological principles is of great value, as it allows us to attack the irritating, generally infectious factor.

The manifestations of arthritis are due to the reaction of the body tissue to the attacking force. They depend to some degree on the infecting organism or irritating factor but mostly on the condition and constitution of the patient. If his joint tissues would not

react too violently there would be no arthritis.

Physical therapy can in many instances act directly or indirectly on the primary causative factor, but if this can not be eliminated then our procedures must be selected with a view to controlling the reactions of the body tissues, to prevent an excessive defense in one case and to stimulate an insufficient one in another.

Physical therapy is the only method by which we can reduce the unnecessarily strong reaction of the body.

Only by a wise selection, by correct indication can we expect either to cure a patient or delay the devastating effects of the struggle between the infecting or irritating factor and the body tissue.

ELECTRICAL ACCIDENTS *

HART E. FISHER, M.D.

CHICAGO

We are living in an age of electrical energy. Its use ranks first in industry today as a means of power supply to run its machinery. Hardly anything in the way of commodities that one might mention but has had electrical energy applied to its manufacture. It is the most powerful and least understood of nature's energies. The practice of taming this energy and making it do the work at man's bidding has exacted a tremendous toll in death and disabling injuries, with great economic loss both to industry and to the families of those unfortunates who came in contact with it.

Great strides have been made in the past and greater prospects are in store for the immediate future as evidenced by the increased voltages that are used today in comparison to those used only a few years ago. It is still in its infancy, but at the rate of growth of this industry in the past, there is assurance that it will reach its adult stage in the very near future. Electrical uses are increasing and with them comes an increasing number of electrical injuries such as electrification (elec-

tric shock), electric burns, and electric flashes or glare injury to the eyes.

The men engaged in the electrical industry have made an enviable record in their efforts toward the prevention of employee accidents, and have held accidents to the public at large down to a minimum. This has been accomplished by the use of safety measures and safeguards thrown around all electrical equipment. A large number of accidents and deaths are attributed to carelessness and the light regard in which the average person holds a low voltage currents such as 110-220, which are the current so commonly used in the home and shop. Many have received small shocks, but beyond the unpleasant sensation have received no further injury. Being thus shocked slightly they have come to believe that the current is harmless. In fact, it is this low voltage that is causing about one-third of all the fatalities from electric shock. More people use the lower voltages, and fewer accidents occur from higher voltages because the workmen in the electrical industry, respect this invisible force with which they daily work and are ever alert to its hazards.

The two most common currents that cause

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our electrical accidents are the continuous or direct current, and the alternating current. The voltages range from a few volts to as high as 250,000 volts and higher. In the alternating current there is a reversal of the current flow at frequent intervals within a second and these reversals are spoken of as frequency. 39 to 60 cycles. The frequency most common in industry and at the same time the most dangerous are those from 39 to 60 cycles.

As regards which types of voltage is the most dangerous it can be answered that both are equally hazardous as to life providing all conditions are equal. There is no actual margin of safety in electrical accidents as even a trivial shocking may be fatal if the skin resistance is lowered by means of perspiration or while washing and the current pathway includes the heart. Fibrillation of the heart is very easily introduced by a slight current, and when once established death is the inevitable result.

The prevalent belief that shock from high currents over 500 volts means death is erroneous. Many times when the physician is called to the scene of accident where a man is found electrified and shocked into unconsciousness by a high voltage, the doctor will, after a cursory examination, pronounce the person dead and no effort will be made to resuscitate him. We have often in our personal experiences known of such cases on which our employees performed artificial respiration and the supposed dead were restored to life, much to the physician's humiliation. This does not look well to the layman, and this is one of the reasons why there is need for actual information on this subject. It is also desirous through your cooperation to prepare the average layman to be efficient in resuscitation technics in cases of electric shock, asphyxiation from gas and submersion by drowning.

Allow me to emphasize three things of great importance as regards electric shock:

1. Look upon all electrical apparatus with awe and respect, regardless of whether it is of low or high voltage.
2. Look upon all people who have become electrified and are unconscious as alive, and treat them by artificial respiration regardless of the voltage received.
3. All physicians should give en-

couragement and cooperation to the layman who is endeavoring to maintain the flicker of life in an electrified person until the doctor arrives.

Variables in Electrical Resuscitation

The question has often been asked of us, What is the longest time it takes to resuscitate victims of the various voltages? To this we say: The severity of electrification depends upon many variables. The voltage or current strength, the intensity or amperage of the current, the time the person is in contact with the current, and the extent of the surface of the body in contact and the nature of the ground, whether wet or dry, the former being more dangerous.

Many times those shocked with the higher voltages have been the easiest to revive, while many cases are fatal in spite of lower voltages and many hours of resuscitation. It is sufficient to say that where a person is found unconscious regardless of the voltage, artificial respiration should be instituted at once and persisted in until either the person shows signs of life or they are known to be dead by actual tests of death. Our periods of resuscitation have been from a few minutes up to 5 hours, and there are cases on record where life was maintained after 8 hours of continuous effort.

Statistics show that a great many accidents occur between the hours of 9:00 - 10:00 in the morning and 2:00 - 3:00 in the afternoon. This frequency peak occurs at the time of greatest digestive activity and as a result of the minimum of blood supply in the brain. At this time drowsiness or fatigue may be the cause of the worker being precipitated into an accident. Also, the greatest mortality in electrification occur during these hours.

The largest number of electrical accidents occur during the summer months, from June through August. These are the periods of maximum outdoor construction when the greatest number of persons are employed in the industry. It would be natural that there would be the tendency to have an increase of electric accidents with an increase of man power. The greatest number of fatal cases occur during these months, and are directly attributed to the perspiration and the lowering of skin resistance which makes the current more hazardous to the worker.

Another question frequently asked of us is the effect of electric current upon people

with physical defects or organic disease. In the 21 years that I have been associated with the electrical industry I have found many employees with heart, kidney, liver and lung diseases who were not unusually affected by electric shock. During this time a periodical medical examination on all employees have been made. We therefore have been able to see them before and after their electrification, and this over a period of years during which time the checkup disclosed no permanent damage to the preexisting physical condition, nor have we seen any permanent complications or remote effects of electrification. This is contrary to the usual claims made by physicians and medical legal experts, who have many times attributed a large variety of conditions to some trivial electrification received weeks or months previous.

Sensations and Effects of Electrification

Many fantastic stories have been told as to the sensations one feels during the period of electrification and I am a firm believer that one's sensations depends upon the ability of the person as a story teller. It is true that some are conscious and know what goes on about them at the time of electrification, and, again, others are unconscious at once on contacting the current and their minds are a total blank as regards past events.

The conditions produced in the human body at time of electrification depends upon the source of energy, the voltage, range of amperage, resistance of patient's body. The low voltages have an affinity for the heart, producing cardiac ventricular fibrillation. The higher voltages produce an inhibition or partial block to the central nervous system, and affect the respiratory center of the brain, producing respiratory paralysis. This form of apparent death is amenable to artificial respiration.

There are painful shocks to the nervous system, unconsciousness from a slight temporary state to a permanent or deep stage. Persistent unconsciousness following electric shock eventually results in death. Other associated symptoms found are mental and nervous instability, inability of voluntary action, muscular contractions, convulsions, and extensive burns, due to the arcing of the current in breaking down the resistance of the skin. With destruction of the skin and underlying tissues by burning, the amount of current entering the body is less than where

only a small skin destruction is present. Large amounts of current enter the body with deadly effect upon the vital organs.

Observations made by medical men who have studied electrocutions of criminals state that temperature rises at the point of entrance of the current into the body at a degree that will melt steel. Temperatures of 150-180 degrees F. have been found in the body tissues. These excessive temperatures in themselves are sufficient to cause death by their action upon the cells of the body.

What are some of the forms of death produced by electric shock? There is general or instantaneous death of the body and tissue cells and its constituent parts. There is heart death through the interruption of the blood circulation in consequence of the over excitation of the cardiac muscle fibers. We also find a so-called brain death through an intensive molecular concussion of the nerve cells of the central nervous system.

Death may be caused indirectly by a trivial shock resulting in falls causing injuries, which subsequently cause death. Again patients surviving the initial electrification die later due to complications from burns that were received at the time of shock. Infection and suppuration from electric burns, and exhaustive and debilitating complications may be the indirect cause of death.

Treatment

Treatment of electric accidents should consist of immediate rescue from the current source and immediate application of some form of artificial respiration, this to be persisted in for a length of time which would assure that further attempt is of no avail. Heart stimulation may be given by counter shock over the heart. Open digital massage of the heart cannot be done in the field, and even though the case was in a hospital, one would hesitate to superimpose operative shock upon electric shock. Injections of drugs of one or another nature into the musculature of the heart are of little value. The mechanical stimulation of the cardiac muscle by the needle is of more value than the effect of the drugs which is secondary. (Hyman.)

Friction of the skin surfaces is of value and the maintainance of body warmth is essential for therapeutic success. Rectal dilatation may be a valuable factor in respiratory stimulation. Inhalations of aromatic spirits of ammonia by means of the artificial respiration

may also be of value. Bleeding is a doubtful measure as we have a lowered blood pressure and further lowering would be fatal. Then, again, we have here a high blood concentration and a dehydration of the body fluids due to the electric burns, and bleeding would intensify this condition. There is a decided danger in bleeding while artificial respiration is in force as from embolus (air).

Time will not permit of going into the other electrical accidents of burns and flashes to the eyes except to state that in 21 years of pre- and post-injury accidents we have had no complications resulting except where the part was actually destroyed by the burns received. No electric cataracts nor defects of vision were a result of this class of injury. No deformity was produced by the so-called electric atrophy due to the passage of the electric current.

Some statistics as regards the most recent group of electrical injuries that have come under our observation may be of interest. These figures show that some of the claims made as a result of animal experimentation are not borne out in actual experience in the field.

TABLE 1

Electric Shock Cases

Non Fatal	166
Fatal	118
Total	284

Fatal Cases

Died in 3 hours to 3 months.....	15
Dead on Arrival.....	14
Dead after Artificial Respiration.....	84
Died before Artificial Respiration.....	5
Total	118

Indirect Causes of Death

Skull Fracture	2
Tetanus	1
Spine Fracture	1
Septicemia	2
Toxic Shock (Burns).....	5
Pulmonary Complications	4
Total	15

Resuscitation Record

Successful Cases	94
Unsuccessful Cases	118
Recovered without Artificial Respiration.....	72
Total	284

Method of Rescue (from current)

	Non Fatal	Fatal	Total
Person able to free self.....	34	4	38
Person fell or thrown free.....	81	47	128
Person rescued by another.....	51	67	118
Total	166	118	284

Out of a total of 284 cases in this series there remained 166 persons who lived following their electrification, while 118 were fatal. Artificial respiration was performed successfully upon 94 persons while 72 recovered without any resuscitative effort. The 38 persons who were able to free themselves were not severely shocked and did not require much attention to recover. Those that were rescued by another were for the greatest part held in contact with the current for periods ranging from ten seconds to ten minutes, receiving a continuous application of current generally fatal (Table 1).

TABLE 2

Monthly Occurrence of Electric Accidents

Jan.	5
Feb.	5
Mar.	4
April	5
May	5
June	13
July	9
Aug.	8
Sept.	4
Oct.	7
Nov.	6
Dec.	4
Total	75

The greatest number of accidents occurred during the months from June through August which were the greatest construction activity periods. This group of 75 cases were taken from the past years records (Table 2).

TABLE 3

Hourly Occurrence

A.M.	Hr.	P.M.
0	1	7
0	2	9
0	3	13
0	4	8
0	5	4
0	6	6
2	7	0
4	8	0
4	9	0
8	10	0
7	11	0
3	12	0
28		47
Total 75 cases.		

The periods of greatest digestion, 9 to 11 in the morning and 2 to 3 in the afternoon, were the periods when the greatest accidents occurred and the periods when the greatest digestive activity of the body took place. This may perhaps account for the accident frequency as due to a lethargic state from lack of blood at the brain during gastric digestion (Table 3).

TABLE 4

Electric Burns

First Degree	376
Second Degree	330
Third Degree	164
Total	870

Anatomical Parts Burned

Fingers and Hands.....	311
Wrist and Arms.....	138
Face, Head, Neck.....	300
Feet—Toes	29
Ankles and Legs.....	50
Chest—Body—Back	42
Total	870

Résumé of Electric Burns

Lost time burn cases.....	494
No lost time cases.....	376
Amputation of parts.....	10
Marked scar formation.....	27
Contractures	10
Keloid Formation	4
Attempts at suicide.....	3
Pliable soft scars.....	160
No after evidence injury.....	376
Faint scarring	280
Physical complications	None

From this group of 870 burns of all three degrees, the hands and fingers were the most frequently burned, due to the manual nature of the employees work. We wish to call attention to the fact that outside of actual dam-

age done by the burn itself we experienced no complications or other defects attributable to the shock or burn itself (Table 4).

TABLE 5

Electric Flashes to the Eyes

Eye flashes	450
Lost time injuries.....	140
No lost time cases.....	450
Average days lost.....	3
Electric cataracts	None
Complications	None

There were no permanent injury nor complications resulting from the flash received and this was proven by the fact that there was a pre- and post-accidental examination of the sight with an observation over a period of many months (Table 5).

Conclusion

A great amount of erroneous information has been given both to the public and the medical profession of remote effect from electrical accidents. In twenty-one years of actual observation on this class of accidents in the field we have not been able to affirm some of the alleged complications that are so often claimed on the witness stand. We should devote more time to this subject through the media of our medical societies and medical schools, and at the same time be the reliable source of information to the general public, instead of leaving it in the hands of commercial associations teaching theoretical first aid. It is the duty of the physician to further this research work, and were we to give but a fraction of the time that is devoted to many other problems of the human body it would be the means of saving many useful lives and preventing numerous invalidism.

79 W. Monroe St.



PHYSICAL THERAPY IN TRAUMATIC SURGERY *

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Physical therapy is as old as surgery, it received its greatest stimulus in this state about twenty years ago when the Workmen's Compensation Act went into effect.

Today it is recognized as a distinct specialty. Its greatest value has been in the treatment of trauma, and as an aid in such treatment it has a definite place. Its purpose is to return to normal or as near normal as possible, traumatized structures. This return to normal must be physiological primarily, that is a functional return and what the surgeon should like is, if possible, a perfect anatomical replacement also. Physical therapy is the employment of such agents as heat, light, massage, water and exercises, either alone or in combination, in the treatment of injuries and illnesses. The use of these physical energies is not expensive, there is no reason why they could not be used in every case without regard to the financial position of the patient. When the treatments are administered by a physical therapist or an aide, the expense of treatment must be considered. The surgeon expects that the physical therapist will be not only a doctor of pleasing personality, gentle and sympathetic, but, also one who will not, by continued treatments which are doing no good, make a neurotic of an otherwise normal person. Especially in compensation cases, the physical therapist may be an agent of much good and can be the agent of evil. Treatment should always be given under the direct supervision and in association with the attending surgeon. It is the prime desire of the surgeon to bring the supine patient to the erect position, the useless part to functional activity. The aim of physical therapy is to increase the blood and lymph supply to a part and thereby not alone aid in the healing of tissues but also in removing metabolic waste products. It should relieve pain and soreness, relax muscles, reduce swelling and promote the healing of wounds. It should help in the rebuilding of

tissues and in the reeducation of muscles. It should be comforting and leave a sense of warmth and relaxation so that the patient looks forward to his next treatment with pleasure. When it is painful it produces muscle spasm and defeats its intended purpose. It is not expected that physical therapy will overcome the results of poor reduction and improper attention. It cannot be expected to correct the disabilities produced by such failures.

Massage should be gentle; it should increase the local blood supply and cause relaxation of tissues, because in this manner it not alone aids in healing, but also in the reduction of local swelling. It should not be forceful and strenuous with a thought toward pressing away swellings, and, as stated before, must not be associated with pain.

Contusions

When tissues are damaged the surrounding muscles splint themselves, as it were, just as the abdominal muscles are "splinted" in the presence of acute intra-abdominal mischief. With such rigidity, swelling due to blood and lymph impairment follows, and atrophy and contracture may result. The damage caused thereby is often irreparable. In the usual trauma there is pain, aggravated by motion, plus loss of function, more or less complete, discoloration and swelling. In this type of injury gentle massage and heat are of invaluable aid in the relaxation of muscles and in the increase of circulation to the injured part, thereby hastening the absorption of exuded blood and lymph, and lessening the period of disability. We have all seen cases of ischemia following fractures about the elbow joint and I recall a series of cases of Volkman's ischemia I saw with the late Dr. Walter Brickner, which were unassociated with fractures, in which the amount of swelling in the soft structures had caused an asphyxia and fibrosis of muscle; a condition we felt might have been prevented by proper physical therapy or a well directed operation.

* Read before New York Physical Therapy Society, November 1, 1933.

Fractures

When physical agents are used, it is my impression that they should be used frequently and for a more or less greater part of the day. Physical therapy will not reduce fractures nor will it retain them. The surgeon asks of it only that it aid in the early restoration of function. Where massage and heat can be employed it should be used soon after injury. It is for this reason that we are in favor of the use of moulded plaster-of-Paris splints as retention apparatus in fractures. With moulded splints it is simple temporarily to remove one of them for the administration of gentle massage and heat. Where circular plaster-of-Paris casts are used, if feasible, the cast should be split and treatments instituted. Of all physical agents in the treatment of fractures, I believe early active motion to be the best. Associated with active motion the whirlpool bath, heat, and massage, are of great value. By these various physical measures, healing of the fractures is aided because the circulation to the part is increased, and good local circulation is essential for the repair of broken bones. Active motion will not allow the formation of adhesions, thereby preventing the limitation in the function of muscle, so often seen in joint fractures that have been immobilized for a long period. It must be remembered that in fractures bones and soft structures are injured. Within recent years diathermy in the care of fractures has come forward, but has been employed injudiciously. Within the past year I have had brought to my attention two cases of fractures in the mid shaft of the tibia that were apparently uniting satisfactorily and with sufficient callus. When union was apparently firm, they were sent to a physical therapist who immediately treated the part with diathermy, and I regret to say that before long the original line of fracture was easily visualized in a radiograph and the callus which was present had been absorbed. From my experience and the experience of some of my colleagues, I must insist that for the time being and until we know more about its use, diathermy in the treatment of fractures should be discontinued. I am unalterably opposed to the use of so-called passive motion. There is nothing passive about hearing a patient screaming in pain while a joint or part is being moved. The occurrence of muscle spasm is a danger signal.

If passive motion must be used it should be employed cautiously and attention should be paid to signs of pain, spasm or swelling. In fractures of an extremity I believe the frequent changing of the position of the limb is a great aid in treatment. When patients are asked to walk, they should not be made to do so either with the foot bare or wearing a slipper. A proper fitting shoe, constructed slipper.⁽¹²⁾ A proper fitting shoe, constructed so as to take care of the results of the atrophy of disuse, must be worn. I believe that occupational therapy, of which I will speak again, is most assuredly the best form of re-education therapy following fractures.

Sprains

There is little doubt that the trainers of athletes have taught us much in the treatment of sprains. With sprains we have probable tears of ligaments and muscle, synovitis and tenosynovitis. Associated with sprain there is hemorrhage. Following the injury there is muscle spasm and local swelling. There is little doubt that too active motion may interfere with the proper healing of the torn structures, but it is equally true that without proper circulation healing would be extremely slow, often resulting in permanent damage. As good circulation is essential for the repair of soft structures; heat and massage, given early, will hasten healing. Active motion of the injured part and, in the lower extremities, weight bearing can be allowed at an early date. Frequent changes of posture are essential.

Dislocations

In all dislocations there is in addition to the solution in the contiguity of bone, soft structure damage, resulting in muscle spasm which itself would keep the reduced dislocation in place. Accordingly I do not feel that prolonged immobilization is essential. While the tear of the soft structures is responsible for much of the limitation of motion following dislocations, the greatest offender is prolonged immobilization. Physical therapy in dislocations, especially of the shoulder, should be instituted at once. Heat, massage and the faradic brush I have found of great value.

Hand Infections

In hand infections I believe hot local baths for fifteen minutes every two hours, plus active motion, are invaluable aids in the restoration of function. Where pus is demonstrated,

it should be evacuated. Exposure of the wounds to light and air is of great value. It scarcely needs emphasizing that reference is had here only to those cases in which the infection is under control.

Bursitis

In the treatment of bursitis I am satisfied that diathermy has a very definite place. Hansson, of the Hospital for the Ruptured and Crippled, has demonstrated a large number of cases of subacromial or subdeltoid bursitis, which have both physically and radiographically splendid results. There are, however, some cases that do not respond to treatment and require surgical intervention.

Occupational Therapy

While physical therapy affords relief of

soreness and stiffness, it will not affect atrophied muscles or stiff joints without exercise on the part of the patient. Active motion is the only factor that will help, but it cannot be employed in the presence of a sore or a stiff part. Physical therapy, by its relief of soreness, stiffness and sprain, should prepare the patient for occupational therapy. By proper selection of manual labor we allow the patient to bring into play all of his muscles without the impression of receiving treatments. Efforts such as connected with the making of baskets, rugs, or pieces of hammered metal, have loosened stiff fingers and knee joints to the point of restoring atrophied musculature to a practically normal condition.

TREATMENT OF ATHLETIC INJURIES *

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CHICAGO

The purpose of this discussion is not to demonstrate new technics in treating athletic injuries but to bring to your attention this fact—that the methods of treating athletic injuries by trainers, coaches and physicians in charge of athletics in our universities and colleges differ in many respects from those practiced by most physicians and surgeons.

As one reads the medical literature on the treatment of muscle injuries, ankle, shoulder and knee joint sprains and compares the treatment suggested with that practiced by trainers, these differences are rather striking. It seems that most athletes prefer the treatment given by the trainer and other cults to that of the average physician. This opinion is based on statements made to me by athletes and by the fact that many injured baseball players travel long distances from many of our large medical centers to be treated by so-called "bone-setters." When the captain of the Chicago Baseball Team suffered from a back injury which was diagnosed as lumbago, the person who was given the credit for the cure was an osteopath.

Having spent many years in dealing with athletes I am taking the liberty of bringing

to your attention my personal opinion for this seeming lack of confidence of athletes and trainers in the ability of the average physician to deal with their injuries. During the past year Dr. Coulter and I have been writing a series of articles for the *Athletic Journal* on "Physical Medicine Applied To Athletic Injuries." There have been many requests for us to recommend a good book on this subject, but when one studies the publications in this field there is very little material of a scientific nature. The one outstanding book on athletic injuries has been written by an English physician. This book is not very satisfactory as the terminology used in English sporting circles is different from that used in this country. Physicians in America have given little consideration to the publication of articles on acute traumatic injuries, such as, sprains, muscle injuries, teno-synovitis, etc. I recently asked a large class of junior medical students if they knew the meaning of the terms "shin splints," "charley horse," "games back," "glass arm," etc., and was very much surprised to find that only a few were familiar with the meaning of these terms. These terms have no scientific basis yet they bring to the mind of those who have participated in sports or cared for athletics, a

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picture of cause and effect which cannot be described in words.

Muscle Injuries and Sprains

The most common injuries occurring in athletic competition are muscle injuries and sprains. What does the medical student learn about the treatment of these conditions? Does his hospital experience give him any practice in treating these conditions? How can the average physician learn how to treat these conditions? A standard text-book of surgery for students and physicians gives what may be said to be a good first aid treatment of sprains of the ankle and then concludes the treatment of sprains by stating that "Sprains of other joints are treated by adequate support and fixation, with adhesive strappings or other supportive dressing." When one compares the trainers method of treating sprains with that given by the average physician, which is about as stated, we have a reason for the preference of the trainer's method of treatment. It may be that many physicians realize the importance of physical therapy methods, but lacking the equipment and the time are forced to use the older methods of treatment.

Perhaps the place where the greatest difference of opinion exists between many physicians and trainers is on the question of fixation or immobilization of joints. Dr. Meanwell,⁽¹⁾ coach at the University of Wisconsin, makes the following statement in his book, "Now there is no one thing on earth so commonly tabooed by both rank and file of the coaching profession, as a plaster cast." This statement interested me, for as an athletic director and a physician I still fear the plaster cast and have never used one in treating acute athletic injuries.

Let us consider this question and endeavor to find the reason for the fear of immobilization. One of the most common injuries of athletes is a sprain of the internal lateral ligament of the knee. How does the trainer treat these cases? In athletic competition the coach and trainer are able to give treatment as soon as the injury occurs. The player is carried to the infirmary and ice bags are placed around the injured part. Following the 10 to 15 hours application of ice bags, the patient is then placed on crutches for about a week, then a cane is advocated, and after about 10 days the patient is allowed to walk without any artificial aid. During this period

the patient is given daily treatments of heat, massage and exercise. The point I wish to make is that in approximately 10 days the patient is walking. Dr. Meanwell⁽¹⁾ advocates complete immobilization of the knee for ten days and then he states, "Get the boy on his feet for restricted exercise, carefully guarding against torsion and undue activity until the leg strengthens . . . There is nothing to equal guarded, active voluntary movement in the limb to restore function." In reviewing the volumes on the Principles and Practices of Physical Therapy, the treatment of this knee injury is considered by four writers. The treatment advocated by these physicians who realize the beneficial effects of physical therapy, would I feel sure, be acceptable to athletic coaches and trainers.

In a recent article in the *Journal American Medical Association* on "Injuries to the Internal and External Lateral Ligament of the Knee," one reads the following statement, "The duration of cast application differs according to the severity of the rupture." In mild cases the cast should be on for not less than six weeks. Only the physician can decide the type of treatment best suited for the injury, but I think many coaches and trainers can still visualize the shrunken limbs which have resulted from long immobilization.

Technic

I wish to present for your consideration several interesting technics which have been useful to me in the diagnosis, prognosis and treatment of two common injuries in athletes; namely, sprained ankles and the so-called "charley horse."

Sprained Ankles. Strains and sprains about the ankle joint are perhaps a more serious problem among athletes in high school than in college. The reason for this will be discussed later. When an athlete reports with an ankle injury, one of the most important facts to discover is just how the injury occurred. The patient is asked to show the exact position of the foot at the time of the accident. If the foot was inverted and extended a tentative diagnosis of a sprained or strained ankle joint may be made. In 95 per cent of the cases this is the correct diagnosis as it is seldom that fractures occur with the foot in this position. If the injury occurred with the foot everted and extended an x-ray is indicated before any treatment other than first aid is instituted, as fractures most often

occur when the foot is in this position. The "hook-slide" in baseball places the foot in this position and accounts for many of the fractured ankles of baseball players.

The prognosis depends on the severity of the injury, but in making a prognosis it is important to discover how often the ankle has been injured. When an ankle is injured the first time one usually finds all the signs of inflammation present to the maximum extent. After an ankle has been sprained several times, another sprain usually produces little or no distress. This is no doubt due to the fact that most of the tissues in that area have been ruptured or stretched. Most of us have no doubt heard the expression "walking-off-a-sprain." This term originated from the method used in treating persons who have had repeated sprains of the same ankle joint. In these cases the foot is strapped and the athlete continues his athletic work. He does not "walk-off" the sprain because he never really had a sprain. He may have stretched some of the tissues, but there is usually no evidence of any acute condition existing in this joint. The only evidence of an injury may be a slight tenosynovitis. Numerous writers have mentioned the fact that athletes recover more rapidly from ankle sprains than non-athletes without giving any reasons for their statements. It is not because they are athletes which makes for the quick recovery but that they have had previous sprains of that joint. The reason so few ankle sprains incapacitate athletes in college is because they were athletes in high school and received their primary injury before coming to college.

Treatment of Sprains

In the treatment of sprained ankles there are just two things I wish to emphasize. (1) The first aid treatment; (2) The protective bandage.

1. If the injury can be treated immediately, that is, before there is any great amount of swelling, ice bags are indicated. Some trainers pack the foot in ice for a short time and then apply a compression bandage. The purpose of this treatment is to prevent the exudation from the vessels; for as Heald⁽³⁾ states, "As an immediate reaction to injury there is dilatation of the blood-vessels, followed by slowing of the stream. Fluid and cells exudate through the walls of the vessels and the site of the injury is gummed up by a

sticky mass consisting of lymph, exudated blood cells, and the dead and dying cells of the part. The 'first-aid dressing' has to be removed before reconstruction of tissue can begin." In athletic contests, where the trainer and physician are at hand to care for the injuries, this form of therapy is possible more often applied than in general practice. When the exudate has infiltrated into the injured area then the application of heat, massage and other forms of physical therapy are indicated. The purpose of the treatment is to hasten the absorption of the exudate.

2. As the early use of the leg and foot is an essential part of the treatment, the proper application of a protective bandage is important. In applying adhesive tape for this bandage the following technics are advocated:

(a) Before applying the adhesive straps the foot must be placed in the opposite position from which the injury occurred. A sprain of the ankle occurs when the foot is inverted and extended, therefore the foot must be everted and flexed. A simple method of obtaining this position is to have the operator sit on a chair in front of the patient who is seated on a high table. The patient rests that part of the foot which is under the lesser toes on the knee of the operator. This places the foot in the desired position for bandaging.

(b) There are many methods of applying the adhesive tape and holding the foot in this position. The point I wish to emphasize is this: When the bandage has been applied the operator should forcibly extend and invert the foot. If the patient complains of pain it indicates that the tape has been incorrectly applied and the bandage is therefore useless in protecting the ankle from further injury.

Treatment of Muscle Injuries

Acute traumatic injuries of muscles are given various trade names by athletes, such as, "charley horse," "game back," "pulled tendon," "shin splints," etc., but the treatment of these conditions with some variation, may be considered as a whole. The pathology which exists in the injured muscle of a track man is similar in many respects to that which occurs in the back muscles of the handball player. The athlete's trade name is very helpful in locating the cause and the muscles involved, but muscle tissue of the same type will respond to practically the same treatment wherever it is located. When a muscle is in-

jured, either by direct or indirect trauma, we may expect a tearing of the muscle fibers with hemorrhage into the injured area, a dilatation of the blood vessels, fluid and cells exudate through the walls of the vessels. This pathologic change produces the signs of inflammation, pain, redness, swelling, increased temperature and immobility of the part.

The purpose of our treatment is to promote absorption of this mass so that healing may take place. Heald states: "That the easiest tissue to produce is connective tissue, and the repair cell which is thwarted by bad conditions in its attempt to reproduce a highly differential cell will stop short at the connective tissue stage." Also: "The more nearly the surgeon can reproduce the protection, sterility, warmth, and nutrition of embryonic conditions, the more successful will be the evolution of a repair cell." The same author also argues: "Hartwell's work suggests that the failure of nerve and muscle-cells to regenerate may be, not an inherent property of the tissue, but rather a failure or inability on the part of the surgeon to reproduce intrauterine conditions accurately enough for these last and most complicated stages of tissue differentiation."

I have often wondered what causes an athlete's legs to go back on him, or makes him a fifth of a second slower in getting started. If it were possible to make tissue studies of his muscles I wonder if we would not find the normal elastic muscle fibers replaced by areas of connective tissue. After many years of athletic competition, the leg muscles are easily prone to a great number of so-called

"charley horses." Muscle tissue which is replaced by connective tissue would lose some of its agility, speed, coordination, and all those quick reactions so necessary for successful athletic competition. It may be that with the advance in physical therapy technics we have at our disposal a method of prolonging the athletic life of our athletes.

Conclusions

The trainer, through long years of experience has developed technic in diagnosis and treatment of acute traumatic injuries which cannot be ignored. With the decrease in the working day and more hours for leisure for physical activities, there will be an increase in the acute traumatic injuries. It is important that the medical profession and especially those interested in physical therapy, give more study to the pathologic states and the treatment of these minor injuries and publish their findings in our journals. The old methods of treating these conditions by rest and immobilization will not give the results which may be obtained by proper physical therapy. Unless more study is given to these conditions and medical students are taught how to give physical therapy treatments, we may expect other cults to take over much of this work.

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ULTRAVIOLET TREATMENT IN CHRONIC OTITIS MEDIA IN THE TUBERCULOUS *

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It is rather surprising that while ultraviolet therapy either in general or in local application has been widely used in cases of extrapulmonary tuberculous lesions, such as joints, lymph glands, and intestines, the treatment has not been tried sufficiently in cases of chronic otitis media, if one is to judge from the meager reports in the medical literature. In a previous contribution, one of us, (Bendove⁽¹⁾) has reported a group of cases of tuberculous otitis media successfully treated with local ultraviolet, and our subsequent observations of the effect of ultraviolet light on tuberculous as well as non-tuberculous otitis media have corroborated the previous findings.

While it is impossible at the present stage of our knowledge, to give a definite opinion as to what influence the microorganism has in rendering cases of otitis media *chronic*, there is no doubt that the persistent otorrhea results from arrested tissue repair which is indicative of poor resistance of the patient. Many therapeutics have been suggested to enhance the resistance of the patient and to stimulate a healthy local growth of tissue repair, but we find that ultraviolet light is the most favorable.

Differential Diagnosis

We must say at the start that it is often very difficult to differentiate between tuberculous and non-tuberculous cases of chronic otitis media. Bacteriologic examination of the aural discharge rarely reveals tubercle bacilli even in cases of frank tuberculosis. Cox and Dwyer⁽²⁾ found that about 15 per cent of all cases of otitis media in children are tuberculous. St. Clair Thomson⁽³⁾ found only 2 per cent definite tuberculous otitis media in a large number of tuberculous cases. Bendove and Lussman⁽¹⁾ found about 14 per cent of all cases of pulmonary tuberculosis develop chronic otitis media, but only a very small percentage of these cases revealed tubercle bacilli in their aural discharge.

Of the 42 cases which we have observed, 25 had active pulmonary tuberculosis and 17 were non-tuberculous. Only 2 of the 25 tuberculous cases showed tubercle bacilli in their aural discharge. No tubercle bacilli were ever detected in the aural discharge of the non-tuberculous group, though many of these cases exhibited the same clinical characteristics as those of the tuberculous group. The impression was gained therefore that the laboratory test for determining the acid fast character of the otorrhea is of rather limited value.

It seems to us that a clinical diagnosis of chronic tuberculous otitis media can best be made from the insidious and usually painless onset, profuse intermittent creamy discharge, at times fetid and bloody in character, and the rapid impairment of hearing. From this point of view, we would say that twelve patients in our group were considered clinically tuberculous, five of whom had no pulmonary involvement and seven had active pulmonary tuberculosis. Ten patients in this group responded very well to local ultraviolet treatment, the creamy discharge ceased and a reactive granulation tissue developed with closure of the drum, though functional restitution was rather the exception than the rule. The clinical course of two of these patients, who gave a history of having had "a running ear" since childhood, was not influenced by the treatment. The only adequate reason we could offer for this failure is that the diseased mucous membrane of many years duration had lost all its ability to give rise to recuperative granulation tissue.

The non-tuberculous cases of otitis media appear at first to be rather resistant to ultraviolet treatment, but a persistent and methodic application of local as well as general ultraviolet radiation will bring favorable results. Most of our patients in this group, irrespective of the predominant microorganism, responded well to the treatment, but the impression was gained that general ultraviolet radiation is just as important as the local application. The intensity of radiation, inter-

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vals of application, as well as the duration of treatment, varies with each case. Of course, in cases of clinical pulmonary tuberculosis we avoid the general application of ultraviolet treatment for fear of reactivating the pulmonary lesion. In these cases we limit the area of radiation to the size of the ear speculum.

If there are deep foci of infection they have to be removed before the treatment is initiated, for the ultraviolet rays must reach the diseased part, if satisfactory results are to be obtained.

To illustrate the use of ultraviolet rays in chronic otitis media after complete removal of foci of infection, the following case, treated by one of us (W.) is very striking:

Case Reports

A young girl, aged 12 years, had a foul discharge from the left ear since eight months of age. Two tonsil and adenoid operations were performed in the endeavor to halt the discharging ear, one at three years of age and the other at five years. At the time of examination she appeared in perfect health and was well nourished. Examination of the right ear revealed a normal tympanum. The left ear disclosed the external meatus filled with foul creamy pus. The perforation was central and in the inferior quadrant. A mixed staphylococcus and streptococcus infection was present. Conductive deafness was evidenced by the Weber test lateralizing to the left and the Rinne on that side being negative with bone conduction increased. Rhinoscopic examination showed a post-ethmoid condition on the left side. Frontals and antra were clear on transillumination. A lingual tonsil was present on the right side and a stump of tonsil in the upper pole of the left fauces. Nasopharynx disclosed adenoid tissue. I treated the post-ethmoid infection with silver packs and drainage, and the aural discharge with an iodine powder. In addition to this, ultraviolet radiation was applied to the entire body twice a week for about two months, beginning with a four minute period and increasing one minute each time. The patient was then admitted on the service of Dr. Lee M. Hurd at the New York Polyclinic Hospital on Nov. 5, 1932, and I performed a tertiary tonsil and adenoid operation removing every visible follicle both in the fauces, lingual area and nasopharynx. I continued treatment to the ethmoid and aural discharge, which though abated, was still present, but not so foul. Ultraviolet light was again resumed twice a week for four minutes to ten minutes. In six months, there was no more discharge present and the perforation had completely healed; the tympanum was completely sealed over with fibrous tissue as evidenced by the Siegel otoscope.

Perhaps by the frequent use of ultraviolet after mastoidectomy, we could prevent post-operative complications. The following case

of a mucous capsulatus infection is very illustrative:

An extensive necrosis of mastoid cells with free pus and exposure of the sinus, due to a mucosus capsulatus infection, progressed very slowly for about two and a half months post-operatively. The treacherous activities, painless and almost symptomless, of this type of organism is well known. This particular case developed a preauricular and post-auricular edema, redness, and a bulging drum two and a half months after the mastoidectomy. A post-operative x-ray revealed no remnants of mastoid cells. Superficial skin incision and a paracentesis caused subsidence of the swellings. The progress seemed so slow, and at times at a standstill, with vague symptoms of headache and a fullness over the right temporal region, that an intra-cranial pathway of infection was suspected. Ultraviolet treatment was then resorted to, with daily exposures, and remarkable results followed in a week. In another week, all drainage ceased and the tympanum and mastoid wound healed.

Probable Effects of Ultraviolet

Successful results in other similar cases have convinced us that we have a very useful therapeutic ally in ultraviolet light, and by its timely and judicious application many a case would go on to healing instead of chronicity.

As far back as 1877, Downer and Blunt discovered that light has the power to kill bacteria. Bayne-Jones and Van Der Lingen⁽⁴⁾ have demonstrated the bactericidal action of the ultraviolet rays by means of the spectrograph; and Mayer and Dworsky⁽⁵⁾ have demonstrated the lethal effect of the rays on the tubercle bacilli. Ultraviolet light causes also a marked local tissue hyperemia when applied to any bacterial infection, and this hyperemia, no doubt, plays an important rôle in the walling off of the lesion. No generalization or standardization of the intensity of the radiation, or duration of treatment can be made for all cases of otitis media, but each case has to be individualized and studied by itself. The duration of the treatment varies from one to three months in post-operative cases, and in non-operative cases several months are usually necessary before results are obtained. As a rule, we continue radiation at least one month after healing of the lesion has been observed.

Technic

The mode of application of ultraviolet treatment in chronic otitis media is always the direct local radiation, whereas in non-tuberculous cases, general radiation is also of great benefit. The interval between treatments va-

ries from two to five days. The time of exposure must be gradually increased. Too intense and rapid radiation should be avoided for it might do more harm than good by melting away of the diseased tissue, whereas mild and slowly progressive radiation tends to increase granulation and epithelization. This holds true in the tuberculous as well as in all the other types of chronic otitis media.

Summary

Forty-two cases of chronic otitis media were treated successfully with ultraviolet light; of these, twelve were clinically tuberculous, and the other of a mixed type infection. Only two of the tuberculous cases failed to improve under the treatment; they gave a history of having had otorrhea since childhood, and exhibited extensive destructive lesions. All the other cases showed a marked anatomic improvement, though functional restoration was noticed only in five cases.

The local use of ultraviolet therapy was always supplemented by general application, except in cases with clinical pulmonary tuberculosis in which general radiation might cause a reactivation of the pulmonary lesion.

The ultraviolet rays must reach the diseased part if satisfactory results are to be obtained. When deep foci of infection are present, they must be removed surgically before ultraviolet radiation is started to insure better results.

Too intensive and rapid radiation can do more harm than good. The time of exposure must be gradually increased. The intervals between treatments vary from two to five days.

The duration of the treatment varies with the individual case from one to several

months. It is advisable to continue radiation at least one month after healing of the lesion has been observed.

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Discussion

Dr. M. L. Harris (Brooklyn, N. Y.): As far as Dr. Weinstein's paper is concerned, I am aware from my own experience that ultraviolet radiation of diseased mucosa is beneficial. I presume if it is beneficial in the larynx, it might also be beneficial in the ear.

I really cannot understand how, if we should have a tuberculous lesion which involves the middle ear or the labyrinth, ultraviolet radiation is going to benefit the lesion locally. I know that general radiation has been used for centuries for diseased or tuberculous conditions of joints.

On the other hand, it is a modality which is worth while using, and I think we should use it where we have made a diagnosis of tuberculous otitis media. The lesion may be limited to the mucosa.

I am very familiar with the work of Dr. Miller. I see most of the cases. There is no question in my mind about the value of his treatment. It is much superior to the electrocautery in a great many cases, for the simple reason that pain and marked reaction are avoided.



THE WESSELY RADIATION APPARATUS IN LARYNGEAL TUBERCULOSIS *

Further Experiments

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NEW YORK

Of all the therapeutic measures used in laryngeal tuberculosis, two are outstanding in that they exert a healing influence on the diseased laryngeal mucous membrane. These two are the electrocautery and heliotherapy. Both these measures belong in the domain of physical therapy. The other remedies used either cleanse the larynx or allay pain temporarily.

The Wessely Apparatus

I use the cautery mainly to collapse circumscribed edematous swellings and to destroy tuberculomas. Having converted these lesions into ulcerations, I begin to use heliotherapy in the form of artificial sunlight obtained from a specially constructed carbon arc, water-cooled quartz lamp. This machine has been developed in the throat department of the University of Vienna by Dr. Emil Wessely and used exclusively in the treatment of tuberculosis of the upper air passages. The carbons used in this machine are impregnated with a metallic salt in order to yield rays having a wave length of 300 mm. embracing the entire ultraviolet of high altitude sun at zenith.

The average time of exposure is ten minutes, given at first every other day, and later at longer intervals. The period of treatment varies with the condition of the larynx, from a few weeks to a year. At the end of treatment the patients are advised to call once a month for observation. Superficial ulcers heal under this form of treatment rapidly and ultimately cicatrize, leaving an uneven surface. Tuberculous granulations shrivel, become shallower and soon disappear. Painful swallowing disappears in many cases following two or three exposures when no change in the appearance of the lesion is yet noticeable. Of course, there are cases with extensive tuberculous

destruction of the upper air passages; destruction beyond repair, where the light treatment gives no analgesia or any other favorable symptomatic results. These are patients with fulminating tuberculous lesions in the lung, whose resistance has sunk so low that nothing could stimulate their recuperative powers to tissue repair.

Recurrences at the same or other parts of the air passages are not uncommon while an active lesion is still going on in the lungs. At any rate this form of treatment gives results which have hitherto not been attained by any other method. The ability to swallow food and drink comfortably gives these unfortunate victims a chance to fight their primary pulmonary affections. Ambulatory and afebrile cases and those with no progressive lesions in the lung are best suited for light therapy.

While the benefits derived from this mode of treatment are many, and improvement and healing in some cases spectacular, there are faults and defects which act as stumbling blocks and which we have to overcome in the future if this therapeutic agent is to survive and be accepted by all laryngologists as the premier and best treatment for laryngeal tuberculosis.

My experience with the Wessely radiation machine dates back since 1925. During these eight years I have had an opportunity, both at the clinic and in private practice, to study and observe carefully the results obtained in over 200 cases with this form of treatment. In this long run of close observation and experience I found faults and defects not only in the technic and administration of light therapy, but in the complicated construction of the machine and in the individual status of the patient. In my first report on the subject, these minor defects were not at all noticed. In the second report they began to appear on the horizon, and now, in this report, I am able to see clearly almost every fault and

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* From the Department of Laryngology and Broncho-Esophagoscopy, service of Dr. Samuel J. Kopetsky, Beth Israel Hospital, New York.

inconvenience coming from the machine, the patient and the place of treatment.

The machine being of foreign construction and complicated mechanism, like every other machine occasionally gets out of order. It becomes necessary to have a mechanic who not only must be familiar with the machine and know exactly what to do in an emergency, but he must be prepared at all times to restore certain parts which, during the work of the lamp, become gradually destroyed because of the extreme heat. The ring which transmits the light from the crater, though made of the hardest steel, can be seen gradually melting away like tallow. There are a great many other troubles arising from the source of light too numerous to mention.

The administration of light therapy cannot be executed with the same technic in all cases. Some find it very difficult to sit straight and hold the metal mirror in a given position. Some are too frail to sit in such positions for ten minutes. Others have a tremor of the hand and cannot hold the mirror in a fixed position. Some, again, cannot control the cough reflex and therefore soil the mirror with a film of pulmonary secretion. Others cannot control the swallowing movements and so cover the mirror with the moisture from the base of the tongue. Bad weather sometimes lasting for more than a week in succession interfere with the regular routine in lengthening the intervals from one treatment to another. Also, unexpected changes in the health of the patient such as a sudden lighting up of the pulmonary lesions and all sorts of intercurrent diseases, in and out of season, tend to retard and delay healing for weeks and months. These analytic criticisms are made not because I find fault with artificial sunlight therapy but rather with the source, with the administration and with the execution of the same. What shall we do to change this? The more time I spend and the more experience I get in treating laryngeal tuberculosis with artificial sunlight, I find that no other form of treatment equals or approaches its therapeutic value.

In order to eliminate the shortcomings enumerated above it is necessary to first make a similar machine of American manufacture, so that this lamp could be easily furnished to all hospitals and sanatoria de-

sirous of treating laryngeal tuberculosis with the most modern means. Machines out of order would then be quickly and economically repaired and worn out parts readily replaced. One wouldn't have to run the risk of waiting months for the specially impregnated carbons.

Indications for Light Therapy

Where and how should this type of treatment be administered? Because this machine is non-portable and requires a rheostat to reduce the voltage and increase the amperage, patients afflicted with laryngeal tuberculosis must of necessity come to the machine. Therefore, only ambulatory and afebrile patients and those with no progressive lesions may avail themselves of this treatment. The majority of sufferers with laryngeal tuberculosis are either bed ridden or else too frail to undertake a trip to the doctor's office or to the out patient department and so must forego the benefit derived from this pain-relieving and healing source of light. It is, therefore, very important and to the advantage of both patient and physician that the treatment be carried out in a sanatorium or hospital where such cases are specially admitted. Bed ridden patients suffering with laryngeal tuberculosis could then be easily moved with the bed to the source of light and irradiated without the slightest exertion. In this manner a greater number of cases would be benefited by light therapy than heretofore.

The technic has been somewhat modified recently in that pear-shaped infiltrations and tuberculomas are no longer irradiated as such, but are first collapsed or destroyed, as the case may be, by either surgery or the electrocautery and the resultant ulcers made to heal with light therapy. In this manner I secure healing much sooner.

Results of Light Therapy in Tuberculous Laryngitis

The best results are achieved in patients with good resistance and relatively good power of regeneration. Such patients are those with mild pulmonary lesions, which either become arrested or show slight progression. These forms are usually afebrile or subfebrile and yield either normal or slightly elevated results with the sedimenta-

tion tests (Fahreus). So far as circumscribed processes are concerned, in a certain number of cases, the use of the cautery, or in tuberculomas, actual surgical removal may bring about healing much sooner. But one must always remember that in certain localities, such as in the anterior commissure where a matting of the cords may take place, and in the region of the processes vocalis where perichondritis and ankylosis may result, these measures are dangerous. In such localities the treatment with artificial sunlight is safe and gives the best results, though it may take from three to six months to accomplish. While in the majority of cases the local treatment with light has no effect on the primary pulmonary condition, in a great number of cases it was observed that with the healing of the local lesion, there was general well being of the patients; the fever slowly subsided, and the pulmonary condition improved. On the other hand, cases were seen in which the pulmonary condition remained the same or became worse, and yet healing and cicatrization were brought about in the tuberculous lesions of the larynx.

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Discussion

Dr. Oscar B. Nugent (Chicago): One must really have done this work to a certain extent to appreciate the value there is in the proper application of ultraviolet to superficial necrosis.

It has been said that the rays should be applied starting with a certain period, increasing one-half minute each time until a five minute period is reached. I agree with him on increasing the time by gradual doses. However, the method of starting out with one minute applies only to certain machines. With some types of generators one minute might be an overdose or an underdose.

Whenever I get a new one I calibrate it to find out its value. Even the same makes of apparatus do not emit the same amount of ultraviolet.

I use a shield over my arm or over the patient's arm or the nurse's arm, and with a small aperture expose the skin and find out what the erythema dose for the skin is at various distances. If I am required to treat in the throat or to treat the eye or the ear at various distances, we will say one inch, I know what the erythema dose is at that distance. Then I calculate that mucous membrane will stand about twice the amount of the skin erythema dose. By doing this on your machine you will have it very well calibrated, and thus avoid over-

treatment. It is very embarrassing to get an ultraviolet burn. It is rather more embarrassing and more psychical than it is a real physical defect.

I have read much of Dr. Miller's work with Wessely radiation apparatus, and I have to say that his tenacity has led him to success with a type of treatment that is unusually difficult both to the patient and to the doctor. I am sure a great many of us would have chosen a machine

that was probably more easy of administration. Ultraviolet treatment in chronic otitis media meets with success only in direct relation to the proper manner of administration. Drs. Weinstein and Bendove have shown us in their paper what really can be done in these stubborn cases by using ultraviolet properly. I am sure a more definite description of their manner of administering the ultraviolet would be greatly appreciated by most of us.

SCIENTIFIC AND PRACTICAL ASPECTS OF MASSAGE *

C. G. A. BIÖRKMAN, M.D.

NEW YORK

Massage supersedes in antiquity all other forms of therapy, drug as well as physical. The surgeon general of the United States Army has aptly said: "Massage began when earliest man rubbed his bruises." A remedy of so remote an origin, used in some form or another by all people, in all climes, becomes finally part of every man's household weapons against disease, and usually suffers neglect by the fastidious hand of modern medical science. I believe that the modern general practitioners as well as specialists in physical therapy are neglectful of massage both as to its scientific aspects and its practical importance. If I can revive a little scientific interest in this old remedy, it will be to our mutual benefit, I hope.

The scientific side of massage is until very recently, poorly represented in the annals of medical history. It is true that the dimly-lit pages of ancient and medieval medicine are occasionally brightened by the fact that every medical genius throughout the ages has shed some light on the subject of mechano-therapy.

Almost five thousand years before our day, the Chinese philosopher, Kong-Fu, left a record of respiratory exercises and manipulations, and 1800 years B. C. the Yoga cult in India used respiratory exercises for religious and healing purposes as recorded in the Veda books of wisdom. Egyptians, Persians and above all the ancient Greeks, Herodikos and Hippocrates, have left behind them prescriptions for massage and exercises. There is in the Berlin museum a two-thousand-year-old alabaster relief from

the palace of the Assyrian potentate San Herib, which depicts a massage treatment as realistically as seen in our clinics today.

The pathfinders of ancient medicine were almost forgotten during the Middle Ages, and it is not until Ambroise Paré in the sixteenth century of our time that we find the scent taken up again and an anatomical and physiological foundation for mechano-therapy sought for.

From then on, much, both good and bad, was written on this subject, but nothing was actually done for mechano-therapy as a scientific discipline until the beginning of the last century, when medical gymnastics and massage took on new life through Per Henrik Ling of Sweden, the founder of the Central Gymnastic Institute at Stockholm. During the last century thousands of students have graduated from that Swedish institution and have spread the knowledge of massage and medical gymnastics to the four corners of the world.

The so-called "Swedish Movements" consisted of massage and medical gymnastics without distinction between the two, often combining both in a simultaneous application on the theory that massage is a form of passive gymnastics. The difference in physiological values between massage and exercise has been cleared up by modern researchers, notably by Pemberton and his co-workers in America. Exercise, however performed, causes metabolic changes not met with in massage. Even very slight exercise produces an increase of lactic acid products in the muscle masses involved, and the pH of the blood is altered by exercise

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 12, 1933.

but not by massage. Changes in metabolic processes as a direct result of massage are probably negligible.

Effects of Massage

Pemberton, Cajori and Crouter have shown by their experiments that massage leaves no such effect as acidosis due to excessive exercise, or alkalosis due to prolonged exposure to heat. The slight diuresis following massage of healthy persons may perhaps be of value in some pathological conditions as also the increased output of nitrogen as noted by Cuthbertson, but we do not know for sure. The claims for massage must forever be empirical. It behooves us, nevertheless, to inquire into this empiricism, and discard many untenable claims. We cannot deny visible and palpable improvement following the exhibition of massage in certain well-defined pathological conditions, for example in traumatic swellings. However, the physiological basis for effects of judiciously applied massage is a question that still remains unanswered.

It is evident that many authorities on massage have had quite a difficulty in explaining the results reached by this form of therapy and therefore many different virtues have been ascribed to the various massage movements. The most common assumption is that massage causes acceleration of the circulation through mechanical propulsion of the blood and lymph and of the resorption rate of inflammatory deposits. To prove this von Mosengeil demonstrated sometime in the eighties, an ingenious experiment consisting of an elastic rubber tube fastened obliquely to a board in such a manner that when the lower end of the tube was placed in a basin of water, continuous stroking on the tube would cause the fluid to be sucked up against gravity. This experiment coupled with the observation of the visible emptying of the superficial veins in the human arm by continuous centripetal stroking was accepted for many years as proof of this theory.

Another related theory assumes that massage quantitatively increases the blood in any part of the body exposed to its action. This presupposes a mechanical congestion of blood in a limb somewhat on the order of Bier's hyperemia. But, if an unmassaged

arm is first immersed in a suitable measuring glass filled with water and the displacement level marked, it should follow that an increase of even a few cubic centimeters of blood in the limb following massage will displace more water than before massage.

No evidence has corroborated this theory of congestion, and the practical application of von Mosengeil's experiment is only apparently correct, since it does not explain the fact that the veins do not refill in the same tempo as they are emptied by centripetal stroking. On the contrary, after a few repetitions of stroking, the veins refill more and more slowly, and after a while it will take longer and longer intervals until the veins bulge as before massage. If the venous blood stream was actually accelerated, the refilling of the vessels would take place at the same rate as the emptying. The theory presupposes a suction action of the veins, but the absence of Henle's tunica elastica in the veins makes suction impossible. It is therefore fallacious to think that massage will act like an alternating suction pump on the veins as it did in the rubber tube in von Mosengeil's experiment. This pertains in equal degree to the lymph vessels since they also lack in elastic elements. Such elasticity and consequent suction power may be present in the arterial vessels, but they do not come in for any direct influence of massage. It is to be remembered, too, that the pulse rate is not noticeably affected by massage. This holds good for the blood pressure as well.

The theory of accelerated resorption of inflammatory deposits due to the mechanical emptying of large veins and lymph vessels by massage is likewise untenable. Even if it could be accepted as a fact that massage does cause acceleration of the circulation, it could only do so during the treatments. How is it then to be explained that evidence of circulatory improvement is doubtlessly present long after the cessation of massage? For example, twenty minutes of massage on a traumatic ecchymosis causes improvement lasting for days. It is also pertinent to recall that a pleural exudate of long duration often starts towards complete resorption from a single thoracentesis producing relatively little drainage. Neither can be explained as mechanical phenomena.

Since it is impossible to remove by any kind of massage an edema caused by renal or cardiac insufficiency, it may be accepted that actual improvement in the resorption rate by massage in other pathological conditions is not due to the mechanical emptying of veins and lymph vessels. That the effect on resorption, whatever its mechanism, is sometimes quite opposite, can be seen in the different swellings resulting from trauma and from acute inflammation. The first is benefited by massage, the latter is decidedly made worse thereby.

The effect of massage on the nervous system has likewise been exposed to much speculation. Pflüger-Arndt's law has been used as explanation of favorable results observed by nerve friction. This law of nerve reaction decrees that a very weak stimulus starts reaction, a moderate one increases it, a strong one blunts it, and the strongest stimulus inhibits reaction entirely. In practice, massage does not follow this law but works just the opposite way, as is observed with Championnière's light effleurage inhibiting pain as severe as that of a recent fracture, and the Swedish tapotement which increases sensibility under any and all conditions.

Explanation of Massage

In the last decade a new theory, first proposed by Rosenthal and further elucidated by Pemberton, holds that massage mobilizes erythrocytes stagnated in the capillary network of the body. The improvement of the blood picture following so-called abdominal massage was observed by Kleen, of Sweden, almost fifty years ago. This theory is of far-reaching value and opens up new fields for the application of massage, especially in those of the anemias in which new erythrocytes are needed to combat lagging processes of oxidation. This is a theory founded on facts easily verified by a blood count, but it does not tell the whole story.

A rational explanation for the good results of massage must be sought for outside the laboratory, because massage on healthy individuals or animals can give us no help in our quest. The effects of massage can only be measured visually and palpably in the rheumatic patient, and from clinical observations the following conclusions can be drawn:

The technic of massage makes use of the following manual operations, viz.: effleurage, friction, petrissage, vibration, and tapotement. The difference of effect by these various manipulations is one only of degree. They all give rise to the same reaction when applied to a rheumatic muscle: pain and a specific reaction of contraction. Light effleurage to a subacute condition produces light sensation and little contraction, while heavy petrissage to an acutely rheumatic muscle gives rise to severe reactions.

Different methods which produce the same reactions must themselves be of a similar nature, and the different manipulations in massage have this in common, that they produce a transient squeezing of the tissues from two sides, be it between the fingers of the operator or between the operator's hand and the underlying bony structures of the patient. Thus the lightest effleurage and petrissage are forms of transient pressure just as friction, vibration and tapotement are forms of prolonged, temporary pressure.

In the rheumatic picture we have two constant features: pain on pressure, and increased tension or hypertonicity. These two cardinal symptoms are the norm by which the effect of massage can be measured. The oftener the massage is exhibited, the sooner the pressure pain and the muscular hypertonicity decrease. This improvement is functional in nature and due to a general decrease of the hypersensitivity and hypertonicity of the rheumatic tissue explainable by the law of nerve fatigue but not by that of Pflüger-Arndt.

The muscle is the tissue par preference influenced by massage and the effect thereof is both functional and anatomical, and depends entirely upon the squeezing or pressure exerted on the contractile substance of the muscle cell. This effect of massage secondarily affects blood and lymph vessels and their fluids, as is seen in the improvement of saphenous varicosities after proper massage treatment of flaccid calf muscles. Resorption of inflammatory exudates and organized fibrinous deposits are consequently influenced.

Non-muscular organs, as the articulations, synovia and tendon sheaths, are influenced by massage to a lesser but not unimportant

degree. Periosteum is very little if at all influenced by massage, except that pressure pain is evidently relieved in traumatic periostitis. Great increase in callus formation has been observed by massage in bone injuries in children, which may be due to stimulation or irritation of the osteoclastic layer of the periosteum.

Fatty tissue is never influenced by massage, but its underlying muscular elements may improve with consequent changes in the contour of the adiposity. The idea emanating from reducing parlors that fatty tissue can be "rubbed off" is of course absurd. The skin is favorably influenced by massage because of its underlying muscular elements.

Contrary to common belief, nerve tissue itself is not changed by massage anatomically or physiologically. I have never seen a paralyzed motor nerve rehabilitated by massage. Functional improvements of a motor nerve is only observed when its paretic muscle is restored to normal by physiologic rest and massage. If the hypertonicity of a rheumatic muscle is decreased, then the irritability of its sensory nerve decreases as well. The common diagnosis of neuritis is erroneous, because there has never been demonstrated any histological changes in the nerve itself while palpable changes in its surrounding tissues are common. Proper myologic treatment cures most of the so-called neuralgias and neuritides. True neuritis due to avitaminosis or specific nerve poisons or to disease of the central nervous system, is, of course, excluded in this argument.

Empirically as well as experimentally we know that the blood and lymph circulation are dependent on normal function and condition of the musculature and that diseased muscles will produce disturbances of the circulation. When massage restores the diseased muscles, improvement in circulation will follow, not only in the extremities, but also in the center of circulation, the heart itself.

One can reach no other conclusion than that massage is above all a treatment of muscle tissue and should be prescribed from that point of view. If we think of massage as a muscle therapy and not as some sort of pumping machinery, it might be possible to remove the stigma justly fast-

ened on physical therapy by Dr. C. R. Murray at our congress in New York last year. He told us that the average disability from fractures of the leg amounted to nine months during a ten-year period of analysis. Haphazard application of intense baking, static and diathermic electricity are responsible for the prolonged disability complained of by him. It is the surgeon's fault if any massage at all has to be used in recent fractures. It is actually harmful as Bohlar has proved beyond doubt. So long as surgeons and physicians decline to interest themselves in the training of masseurs, that long will massage show poor results and physical therapy in general will have much to atone for.

Summary

Massage, then, is not a miraculous cure-all, but a remedy which can be advantageously applied to a multitude of conditions. Its chief value lies in its unfailing effect on hypersensitivity and hypertonicity of the motor engines of the body and its secondary influence on circulation and resorption.

The muscular system accounts for fifty per cent of our body weight and most of our bodily discomforts are manifested in the muscles. We have therefore in massage a remedy of almost universal application, since only excruciating pain and acute inflammation contraindicate its use. Why should we then frown upon the more or less empirical grounds upon which we must prescribe it? And why should we pass up such an excellent chance to improve our economic situation as by having a well-trained masseuse in every doctor's office?

It cannot be expected that every doctor should be an expert masseur, but he should know the fundamentals of massage and what to expect of it. A properly trained masseuse can easily hold many patients in close contact with the office six times a week instead of about once a month. Every patient expects that something should be done to allay his discomfort and while the doctor studies the case and necessary laboratory and other investigations are under way, something good can actually be done for the waiting patient by routinely exhibiting massage. It is improper to send patients to an independently practicing technician.

(Concluded on page 442)

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

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E D I T O R I A L S

THE PHILADELPHIA SESSION

If you have not already arranged your schedule so that you can attend the 13th annual session of the Congress in Philadelphia, September 10 to 13, please do so at once. The program has been completed. In the opinion of the local and general convention committees it is by far the best program which has ever been offered. The diversity of subjects, the arrangement of the specialties, the clinics, conferences, scientific and technical exhibits will afford visiting physicians every opportunity for an interesting and profitable scientific medical gathering.

Transportation

Special rates have been granted by nearly all of the railroads for the benefit of members of the American Congress of Physical Therapy and dependent members of their families who will attend the annual session at Philadelphia. Detailed information is given in the preliminary program. It is necessary, however, that each member secure A CERTIFICATE from the railroad ticket agent when he purchases his ticket to Philadelphia. This will entitle him to one-third fare, returning to his home, providing the required number of certificates are secured from those coming by railroad to the meeting. BE SURE TO ASK YOUR RAILROAD TICKET

AGENT FOR A CERTIFICATE WHEN PURCHASING YOUR TICKET TO PHILADELPHIA.

It should be noted also that there are in effect summer excursion fares from certain sections of the country and that these fares are, in many instances, lower than convention fares. Physicians who contemplate coming to Philadelphia should obtain detailed and authentic information from their railroad passenger agents.

Hotels

The Bellevue Stratford because of its location and historic background has been selected as the official headquarters for the 13th annual session. The accommodations for the meetings and exhibits are ample. Rooms may be reserved by writing directly to the hotel management, or if you prefer, to the *executive secretary*, American Congress of Physical Therapy, 30 North Michigan Avenue, Chicago. Specify the type of room you prefer, the rate you wish to pay, and reservations will be made accordingly. Single room with bath may be had for \$3.00 per day; double room at \$5.00. These special rates apply to all visiting physicians and their families.

Philadelphia — An Ideal Convention City

Visitors will find Philadelphia an interesting city. Many places of historic significance

can be visited by the members of your families while you are attending the scientific sessions. Atlantic City is just one hour's ride. It is an ideal vacation spot. September is a good time to take your vacation, and the meeting in Philadelphia offers you a fine opportunity to combine your vacation and scientific interests.

Philadelphia is one of the outstanding medical centers of the country. Several of the leading medical schools and clinics afford one an excellent opportunity for observation and instruction. Philadelphia also has many splendid hospitals.

The local committee will leave no stone unturned to welcome you most heartily and to make your stay in Philadelphia a pleasant and profitable one.

MADAME CURIE

On the day when our Republic was celebrating another anniversary of its independence, France, and with her the world of science, lost a great figure in the person of Madame Curie. Of Polish parentage she came in her youth to Paris like countless other foreign students in search of knowledge. Soon she attracted the attention of her teacher, the great Pierre Curie, for her earnestness of purpose, her thirst for knowledge, her natural talents, and for her innate modesty and kindness. From a feeling of comradeship in Curie's epochal labors in the field of radioactive substances, the young Polish scientist became more than a co-worker, for based on a feeling of mutual respect and admiration there sprang up a sentiment of kinship and congeniality which resulted in an ideal marriage. Madame Curie never ceased to be a fellow scientist and co-worker of her idolized husband until, in 1906, a cruel accident snuffed out the life of her teacher, co-worker, friend, and husband after eleven years of marital life. Madame Curie honored the memory of her husband by continuing in the research both had begun jointly and which has presented to the world the gift of radium in the year 1898, a gift that has brought succor and cures to countless sufferers from malignant disease.

Although handicapped by lack of material means needed for the expensive research in radium physics and indirectly in radium ther-

apy, Madame Curie carried on with great courage and self-abnegation. The French government and private individuals and organizations at home and abroad, recognizing the humanitarian quality of her work, came to her aid by providing the money and facilities for her efforts. The annals of radiology bring many testimonials of the fruitfulness of her labors now ended. At the comparatively early age of sixty-six years her brain is stilled, her eyes are darkened, and her hands palsied in that deep sleep from which there is no awakening. There is an element of sadness in her demise, because under ordinary circumstances she could have remained alive for some time to come. But Madame Curie had chosen to lead the life of a warrior, and like many a warrior she fell on the field of honor, at her post of duty. A victim of her work in the eyes of the world because her constant exposure to the dangerous rays developed in her famous teaching and research laboratory affiliated with the Sorbonne, an incurable disease, she will go down into history as a great benefactress of humanity rather than a martyr in the cause of science.

Her life has been replete with honors such as have come to no other woman in the world of science. Two times she has been the recipient of the greatly coveted Nobel prize, and the French government broke with its tradition and appointed her to fill an important chair in one of the greatest institutions of learning. But throughout her life she has never stressed her academic degrees and titles and remained content with the simple, democratic designation of Madame, evidently to let the world know that she wanted nothing more than to be known as the wife of an illustrious savant. In death another honor awaits her memory, a movement being already initiated to have her mortal remains placed in the Pantheon, the national mausoleum reserved for the illustrious dead of our great sister republic. That in all probability would be against her wish, for she had no other desire than to be laid to rest alongside the sepulcher of her husband. Nor is there need for such official honor, because her laboratory remains a living reminder of her life's work and her contributions to science are a glorious legacy to posterity, which will forever assure the gratitude of all of humanity. What greater glory can there be to any man or

woman? The membership of the American Congress of Physical Therapy and the editorial staff and readers of the ARCHIVES share with the world of science the great sense of physical loss, which is softened by the conviction that our world has become a bigger and better one because in it have lived and toiled a Pierre Curie and his glorious co-worker — Madame Curie.

THE CALIFORNIA POST-GRADUATE SEMINAR: A MEMORABLE EVENT

The recent post-graduate seminar in Los Angeles conducted under the joint auspices of the Western Section of the Congress and the Pacific Physical Therapy Association, was a memorable event. It created new regional standards, the results of which require the perspective of time to be completely evaluated. To many the memories of that day will remain as vivid and warmly pulsating as though they were etched in an indissoluble present. The spirit and high purpose of the meeting appeared to permeate the large assembly, giving it rare dignity and intellectual tension.

Viewed from the vantage of one who traveled several thousand miles to participate in the program, the event appeared to have that extraordinary setting of a continuous climax within the frame of an unusual experience. To travel for days and nights through a kaleidoscope of scenic beauty was in itself an adventure the description of which can be done justice only by the epic tones of a lyricist. Such an excursion offers opportunity to evaluate impressions of an immensity of country: flat lands, rolling lands, sparse and verdant lands, majestic mountains of variegated colored rocks whose architecture are reached to sheer heights or to profound depths, —peaks, gorges, canyons, colors,—an orchestration of beauty that at times became so burdensome as to make one crave the darkness of the starfilled nights.

And then as if the wish was father to the fact, one awakens into a fairyland of sub-tropical flora and heightened sunshine. Bright hued flowers chatter welcome, orange groves send perfumed messages of greeting, and palm trees sentinel one's passage into a city, poetically described as the place "of angels," a city that wears the uniform of good will and the elusive charm of holiday spirit. To

describe the city and the surrounding territory one must invoke the superlative expression, and to dare this, one would soon wallow in high colored platitudes. Let us content ourselves with the simple assertion that Los Angeles is a rare jewel set in an exquisite environment. To most of us, the Pacific littoral is but a location beyond the Rocky mountains. In truth it is a veritable empire glorified by a beneficent Nature, spacious and beautiful beyond description.

One learns to feel pride in a citizenship of a land so tremendous in size, so varied in climate, so progressive in spirit, and so fertile in yield. No less proud should one be of the accomplishments in scientific medicine and the rôle Physical Medicine is playing in contemporary practice. To record the fact that intelligent and unselfish organization has given birth to a Congress on Physical Therapy, continental in scope and unified in scientific purposes, is a task of great encouragement to all who realize its potentiality. To have participated in the scientific transactions of this seminar under the dignified chairmanship of Worster and the executive ability of Hibben, enables one to give expression of appreciation of the high intelligence and creative leadership that were responsible for the development of a scientific spirit of our discipline on the Pacific Coast.

Undoubtedly, most participants came for the text of the meeting and were carried away by the spirit. That organized medicine on our Western coast is showing more than passing interest in Physical Medicine as a part of scientific medical practice was indicated by the report of Hibben, who was responsible for the creation of a special committee to control physical therapy practice in California, a State which undoubtedly has suffered more from an influx of pseudo-medical parasites than any other. Hibben as chairman of this special committee, presented a comprehensive outline of its aims to eradicate unethical and unlawful practices, and to further by organized effort the development and recognition of scientific physical medicine. That there is urgent need for such action was also emphasized by Behneman, who drew a vivid picture of the struggle of legitimate practitioners against the unfair competition now extant in California. As an effective remedial measure he proposed that legitimate medical prac-

titioners become better acquainted with the technics and therapeutic possibilities of our discipline.

The present flurry of acute and anterior poliomyelitis on the coast offered a timely setting for its discussion by Lowman, in which he brought out the effectiveness of electrical and therapeutic measures. Equally timely, therefore, was the presentation of a paper on Electrophysiology by Kobak which contributed to a basic concept of the clinical application of electrical methods for diagnostic, prognostic, and therapeutic purposes.

A subject that aroused especial interest dealt with various problems of heat as produced by different forms of high frequency current. Professor Moor opened this phase of the seminar by an illustrated presentation of his laboratory studies pertaining to the comparative penetrating qualities of dia- and radiothermy, which established the deeper penetration of the latter. Kobak expatiated on this very problem by a review of the present status of deep heat therapy, which in the main substantiated clinically the experimental data elaborated by Moor.

Behneman informally summarized his studies on the results of exposure of bacterial cultures to ultraviolet light, which led him to accept that whatever bactericidal effects ultraviolet radiation has produced *in vitro* can be interpreted for the human economy only in the sense that it increases the defensive forces of the blood. Kobak's address on the present status of ultraviolet radiation from a general therapeutic point of view, extended the scope of ultraviolet radiation, and at the same time supported Behneman's deductions regarding the limited value of the bactericidal properties of ultraviolet light.

A new evaluation and technic of colon therapy was presented by Worster, who demonstrated a painless method of treatment, a new instrument (the Dierker), whose action was odorless, inoffensive, and stimulating. This instrumentation was said to provoke an intestinal massage by hydraulic force, pro-

ducing an alternate expansion and negative suction on the colon. This treatment tends to loosen old incrustations of mucus and feces, thereby freeing the contents of "pockets" and diverticula. The material thus freed is not necessarily passed through a tube, but in a normal manner, peristalsis being stimulated and the muscularis reeducated. Worster claimed that of the conditions which have responded to a certain degree to colon therapy, may be mentioned high and low blood pressure, arthritis, toxic goiter, migraine, neurasthenia, anemia, asthma, many skin affections, and other conditions.

The evening session following a delightful banquet concluded the day's seminar, so rich in deliberations, many of which cannot even be mentioned for lack of space. Presided over by the distinguished surgeon, Toland, President of the California State Medical Association, the members and guests were accorded a pleasing as well as an intellectual evening. Wyatt, director of the well known arthritic clinic in Tucson, Arizona, presented an excellent summary of the present status of arthritis and the place of physical therapy in its management. The presence at this evening session of the distinguished internist, Wilson, Secretary of the Los Angeles County Medical Society, not only added dignity but also indicated the support of organized medicine.

It is only proper to pay tribute to the fruitful efforts of Hibben, whose skill and seriousness of purpose was instrumental in conceiving and realizing the event above narrated, which means so much not only to the medical profession in the West, but to physical medicine in America. This accomplishment was of course in no small measure due to the wholehearted support of the membership of the Pacific Physical Therapy Association, to manufacturers of physical therapy apparatus, and last but not least to the large number of intelligent and ethical practitioners of medicine who were responsible for the full attendance. West and East have come closer in the comradeship of scientific Physical Medicine.

Correspondence

Of the many interesting letters received in response to the recently published paper in the ARCHIVES by Dr. J. S. Coulter, on a plan of a Registry for physical therapy aides, the following are presented to indicate opinions geographically as well as authoritatively.

—EDITOR.

Philadelphia Approves

To the Editor:—A careful perusal of Dr. John S. Coulter's "Plan for a Registry of Physical Therapy Technicians," leads me to desire to express my hearty indorsement of the plan in toto.

The sooner such a Board with such a medical and technical representation is formed the sooner scientific physical therapy will be established upon a working basis and the sooner misunderstandings between earnest physicians and equally sincere technicians will cease. Certain physicians may object to the presence of a technician on this Board but it seems eminently fitting that one representative from this group should serve.

The only thing that seems to be missing in Dr. Coulter's article is a description of the method whereby the Registry is to be inaugurated.

I for one am extremely anxious to have the mechanism of its inauguration completed and to see this Registry established as soon as possible.

FRANK H. KRUSEN, M.D.,
Broad and Ontario Sts.,
Philadelphia.

New Haven Approves With Modifications

To the Editor:—Dr. Coulter in his plan states that since physical therapy is a part of medicine, technicians should be judged by the medical profession. Then in the suggested Board of Registry, one out of five would be a layman from the American Physical Therapy Association. Besides that number, two would be from the orthopedic societies. It is felt that the orthopedist requires an especially trained individual with great emphasis on muscle training, plaster work, etc., not as general nor as broad as is required by one who does the general work of a hospital or clinic. Since the majority of the leaders of the American Physiotherapy Association were trained as orthopedic assistants, the proposed plan would make the Board predominantly orthopedic which the general field of physical therapy is not, hence three, if not all the members should be from the Congress.

Under "eligibility" it is strongly felt by several of us in the teaching field that two years beyond high school, devoted exclusively to physical therapy, would be sufficient training. It certainly would include more than most, if not all physical education schools now give. These schools naturally tend to emphasize their fun-

damental subject, physical education. They are largely lay-owned and directed, and the incidental physical therapy courses somewhat inadequate for general medical and surgical work.

Under paragraph 3, it is my impression that, the present stringent regulations for membership in the American Physiotherapy Association are of comparative recent origin; that there are, and have been, many acceptable members who have nowhere near the equivalent of the present requirements; that it is usually the custom for new laws to give recognition to those already in a field, I would, therefore, think the term "reasonably equivalent in theory or practice" would favor such present or former members, and give proper recognition to the general high standing of the Association's membership.

The whole idea put forth is most admirable, and I hope it will go through, but with my entire training — physical education and orthopedic — I do not feel that either should take dominant part in the training or registry of physical therapy technicians in this medical field. I feel that the Congress should control registration and that we should have an associate membership for technicians.

H. E. STEWART, M.D.,
303 Whitney Ave.,
New Haven, Conn.

San Francisco Approves With Reservations

To the Editor:—This letter concerns two subjects which I feel you are aware have been constantly in my mind for some time. One of them I brought up two years ago at the meeting of the American Congress of Physical Therapy in New York. That is the subject of affiliation of Physical Therapy technicians of accepted standing as associate members in some way of the Congress of Physical Therapy. There are several technicians here waiting to apply if this can be put into effect at our September meeting. They would rather join the Doctor's National Organization than the National Association of Technicians.

The other subject I wish to mention is the desirability of doing something soon regarding the registry, nationally, of accepted technicians. I have carefully read and considered Dr. Coulter's very excellent suggestion on the registry of these workers. I feel, however, that a better plan would be registry with a national organization with men active in that organization in all parts of the country such as the American Congress of Physical Therapy. In other words I feel that the bad feature of the Coulter plan is that that small committee, so centrally located as it undoubtedly would be, will be too far away from most of the actual workers. As you know, the entire West has not and never has had even a representative on the Council of Physical Therapy of the American Medical Association. If the registry of technicians was a part of the Congress, the Congress could always put its finger on reliable Fellows who would honestly investigate and report what the registry committee wished

to know concerning applicants for registration and those already registered. With a small committee so centrally placed in the country, as Dr. Coulter suggests, there would be a tremendous amount of correspondence with no key men to contact for information. Even if Coulter's committee were picked from various parts of the country, I still feel it would be difficult for these members to carry on even by extensive correspondence, properly. Undoubtedly, in my mind the most logical registry of all would be the Council on Physical Therapy of the American Medical Association, but if that body continues to confine its membership to the eastern third of the country, then that too would probably not work out. I, therefore, am urging registry in the American Congress of Physical Therapy, a special committee being created.

H. M. F. BEHNEMAN, M.D.,
384 Post Street,
San Francisco.

New York Offers Practical Suggestions

To the Editor:—The very timely article of Dr. John S. Coulter, which appeared in the April, 1934 issue of the ARCHIVES, brings up some points that I feel should be kept open for discussion.

There is an undoubted need for a central registration bureau for physical therapy technicians and, of course, the proper place for the publications from this bureau is in the ARCHIVES and the registry should be kept in a central city such as Chicago. The "objects" are certainly what would be in the mind of every one considering this question, but the main point I wish to discuss is the composition of the Board of Registry.

In the Central West the orthopedic surgeons utilize a few forms of physical therapy but there is no reason to believe that physical therapy is in any special way related to orthopedic surgery. Therefore, I do not believe that any representative of an orthopedic organization should have preference in being represented on the Board of Registry any more than a representative of a fracture, surgical or society of internal medicine. Physical therapy in the East is utilized a great deal more by men who are not orthopedic surgeons than by those specialists and as physical therapy is a part of general therapeutics. I do not see why any one but a physician working in physical therapy should be on the Registry Board except as a consultant.

The American Medical Association represents organized medicine throughout the United States. The American Congress of Physical Therapy, composed of members and fellows of the American Medical Association, constitutes a group which is particularly interested in the field of physical therapy, including those who are specializing in the work. Therefore, I think that the chief members of the Board of Registry should be fellows of the American Congress of Physical Therapy and there should be four such members of the Board. The control of the technicians should be in the hands of the doctors who train and use them and who are conversant with all forms of physical therapy and not a spe-

cial part of the work such as is used by the orthopedic surgeons.

As a consultant acting upon the Board of Registry, I think that a member of the Council on Medical Education of the American Medical Association should be appointed so that this Registry can work in close cooperation with the above mentioned Council. As another advising member of the Registry, the President or Presidents of any international technician society should be appointed.

This will establish a liaison between the technicians' own organizations and the Board of Registry, together with close contact with the Council of the American Medical Association that is interested in the problem of education and training.

I am firmly of the opinion that the control and organization of all activities in the field of physical therapy should remain exclusively in the hands of the American Congress of Physical Therapy, with the backing of the American Medical Association. I do not feel that we who are doing this work need to appeal to the special medical societies for advice.

There is one more possibility as a member of this Registry that should be considered and that is a member from the American Hospital Association in order to coordinate the requirements for the employment of technicians in hospitals and then also there will be a representative of the bodies which employ the largest number of technicians. This is mainly to safeguard the hospitals as to the quality of the workers they employ and also give the Board an opportunity to understand some of the technicians' problems in hospitals throughout the country.

Just one more point that has not been brought up in the outline by Dr. Coulter and that is concerning the examinations for admission to the registry. The qualifications as listed by him are perfectly in accord with our ideas of today, but for those who wish to join the Registry and could not come up to the qualifications exactly, there should be some certain set examinations held to give these technicians an opportunity to join. I think the examinations should be written, oral and practical and should be conducted at the convention of the American Congress of Physical Therapy under the supervision of the four members of the Board of Registry who are members of the Congress.

Hoping these ideas will contribute towards the final solution of the problem which I think can be entirely discussed and finished at the next annual meeting of the Congress, I am

NORMAN E. TITUS, M.D.,
57 W. 57th Street,
New York.

American Physiotherapy Association Sympathetic to Plan

To the Editor:—Will you kindly publish the following comment on a recent article published in your Journal?

In the April issue of the ARCHIVES an article, "A Plan for a Registry for Physical Therapy

Technicians" was published. The Executive Committee of the American Physiotherapy Association has adopted the following motion:

Believing that the "Plan for a Registration for Physical Therapy Technicians" by J. S. Coulter, M.D., is an intelligent and workable plan, the Executive Committee of the American Physiotherapy Association, goes on record as being in sympathy with it.

MARGARET S. CAMPBELL,
President,
Chicago.

The Balance of Power

Dear Dr. Coulter:—I was pleased to read your article in the April issue of the ARCHIVES OF PHYSICAL THERAPY. The thoughts you expressed were a step in the right direction. You asked for criticism and I give you my personal opinion.

I think it ideal to have a board to register technicians. However, I feel that the way the board is formed gives a balance of power to the Orthopedic surgeon rather than to the Physical Therapist in general.

In looking over the list of alumni of the Southern California School of Physical Therapy, I find that 85 per cent of all its graduates are now holding positions, and giving it a further check, I find that only about 15 per cent are working directly for Orthopedists and the other 85 per cent are in doctors' offices, clinics, sanitariums, and hospitals in general. The training required for the 85 per cent is more general while that for the Orthopedic surgeon is more specific. Because of this I would suggest that the American Congress of Physical Therapy be permitted to choose three members of the board.

I would further suggest that the schools of physical therapy be continued as they are, i. e., a nine months course of 1,200 hours of work and that the entrance requirements be made one year of college work to include physics, chemistry, and biology, or two years of general college work. Also that the graduates of these schools be permitted to register and receive their R. P. T.

I would suggest that certain schools be permitted to offer a post-graduate course with special training along the line of orthopedics, this course to be given in connection with some hospital that has a large orthopedic department.

I note that you are making it possible for all members of the American Physiotherapy Association to register. I have no objection to this but I am quite sure that many of them never had a nine months course but have had such training since graduation as would be equivalent to a nine months course. If you let these register "en masse" I cannot see why another paragraph should not be inserted reading something like this: All graduates prior to the formation of this board who completed at least a nine months course including at least 1,200 hours and whose school was accredited by the American

Physiotherapy Association at the time of their graduation be permitted to register. I feel that this is just and treats all alike. All those who are in training at the time the board is formed should also be permitted to register at their graduation but those who enter school after the formation of the board should be required to live faithfully up to the regulations of the board with no exceptions.

I wish to assure you that this school will cooperate with you as far as is possible.

Very respectfully yours,

WM. W. WORSTER, M.D.
205 S. Mission Drive, San Gabriel, Calif.

Comments From Dr. Coulter

To the Editor:—I am naturally pleased at the response my plan for a Registry for physical therapy technicians has elicited. The fact that they represent the opinions of men who have reached authoritative standing in physical therapy and allied branches of practice, and come from various sections of our country, is an indication that the subject has been given serious consideration for a long time. Being but a "plan" of one who likewise appreciated the need and importance of such a registry, it was presented as a tentative discussion in the hope that it would arouse sufficient interest of others to give it the final form it is assuming. Since one rarely can envision the entirety of a structure — its weakness and its strength — it is to be hoped that out of this discussion there will develop the necessary perspective of a practical and substantial plan, equitable, tolerant and far-seeing, which will provide for a plan for a registry for physical therapy technicians under benevolent control of regular physicians and in a central location like Chicago. The letter of Dr. Gaenslen of Milwaukee, which I quote below, is a gratifying index of the cooperation and sympathetic support to be anticipated. He says:

"I am writing to inform you that Dr. Henderson has appointed me as representative of the American Orthopedic Association in whatever consideration may be given to the matter of the registration of physiotherapists. I would like to have a rather full statement from you so that I will know just what the points at issue are. Assuring you of my desire to cooperate in every way I can, I am,

Yours sincerely,

FREDERICK J. GAENSLER."

I believe it best that the present organization of technicians should remain intact as an autonomous body, but under the guidance of the best precedence of organized physical medicine. I am receptive to any modification of this plan which will give it authority and invite the cooperation of other allied groups (such as the American Hospital Association, from whom a letter is appended) in order to make it a lasting and substantial contribution for the benefit of all.

JOHN STANLEY COULTER, M.D.,
122 S. Mich. Ave., Chicago.

Dear Dr. Coulter:—I have just gone over your reprint, "A Plan for Registry of Physical Therapy Technicians," which interests me greatly. As a chairman of the Division on Hospital and Medical Practice of the Council of the American Hospital Association, I am assisting in preparing a manual on good hospital practice. I enclose

the proposed chapter on Qualifications for Clinical Laboratory Technicians, as a sample of what we are attempting to do. We are interested in a chapter on The Qualifications for Physical Therapy Technicians.

R. C. BUECKI, M.D.,
Madison.

Radio Knife Invented As Aid to Surgeons

Medical men are hailing a new radio knife for surgery as a boon to surgeons and patients alike.

C. J. Breitwieser, graduate research student at the California Institute of Technology, in his spare time and with his surplus cash, built apparatus for converting an ordinary scalpel into an electrical instrument by high frequency radio waves.

At a demonstration of the instrument at the Monte Sano Hospital, Los Angeles, prominent medical men, and Dr. Lee DeForest, famed radio audition tube inventor, were astonished and enthusiastic over operation of the instrument and apparatus, a vital part of which are two vacuum tubes that cost \$35 each.

The radio knife has many advantages over the electrical knife now in use, said Mr. Breitwieser, listing them as follows:

Need for cumbersome wire connections between the knife and electricity source is eliminated, and wire connections to the patient are abolished.

Being free of electrical connections and insulating material, the new knife is easier to sterilize.

Electrical properties can be given the surgeon's scalpel or operating knife.

Apparatus used to radio current to the knife can be used to keep the patient warm.

Possibility of electrical shock to either the patient or doctor is eliminated.

Another important feature is that the danger of sparking is minimized by the radio knife, thus adding another safety factor to electrical surgery.

Not having human patients on which to experiment and operate, Mr. Breitwieser "operated" on chunks of beef, demonstrating that high frequency radio waves are practical in surgery.

While the use of high frequency electricity as a cutting medium is widely known, the possibility of getting the power by radio waves is a decidedly new development.

Electrical surgical knives cauterize the tissue as they cut, reduce the flow of blood, and are said to result in swifter healing than a cut by a non-electrified scalpel, and to leave less of a scar. — *Science News Letter*, May 19, 1934.

Infrared New Detective Aid to Art Connoisseurs

Infrared light, invisible to the human eye, has come to the aid of art connoisseurs in their search for the truth about questionable masterpieces of painting.

Infrared photography can be successfully used to detect the chemical composition of the paints that an artist employed on a canvas. So the American Association of Museums was told by Dr. Maximilian Toch, well-known New York chemist and specialist in scientific methods of examining paintings.

Even though two strokes of green paint may look alike to the naked eye, the infrared light will photograph one white and another black, if one is chromium oxide green and the other chrome green. Since certain pigments did not come into use by artists until certain historic periods, and since famous artists tended to choose the paints that best suited them, the kind of pigment on a canvas may be a significant clue to its age and authenticity, Dr. Toch showed.

"My contention," said Dr. Toch, "is that all pictures of a certain period by the same artist were painted with the same type of pigments, for even today one seldom finds a painter of note who flounders around and changes his pigments every few months.

"In the case of Frans Hals, Van Dyke, and men of that period, it is quite obvious that they had very few pigments to choose from and therefore any one of those paintings would show characteristic effects on the infrared plate. If, however, a student two hundred years later who ultimately became famous, copied one of these paintings, his work may be accepted as genuine — yet the pigments might be so totally different that the infrared might show them up completely."

Dr. Toch stated that he has photographed a large number of colors by infrared, all of which might be used as standards. Almost every color in use today is recorded. — *Science News Letter*, July 14, 1934.

SCIENCE, NEWS, COMMENTS

Twenty-four Students Graduated by New Haven School of Physical Therapy

A class of 24 was graduated as physical therapy technicians from the school, Friday morning, June 8th, 1934. The graduation address was delivered by Daniel P. Griffin, M.D., of Bridgeport, Conn., who took as his subject, "The Psychology of the Patient." The President of the class, Theodore Anketell, introduced the class historian, Florence Knoblock of New Haven. After a brief address by the Director, Harry Eaton Stewart, M.D., the diplomas were presented to the class.

Madame Curie Dies

Mme. Marie Sklodowska Curie, co-discoverer with her husband of radium, died of pernicious anemia at a sanatorium near Sallanches, France, July 4, aged 66. It was said that her long exposure to radiation probably hastened her death. Madame Curie was born in Warsaw, Poland, Nov. 7, 1867, and received her early scientific training under her father. After taking a degree in science at the University of Paris, she was married in 1895 to Prof. Pierre Curie. They began research on radioactivity in 1896 immediately after the property had been discovered in uranium by Becquerel. In 1898 they isolated radium from pitchblende. The Royal Society of England awarded the Curies the Davy medal in 1903, and the same year the Nobel prize in physics was awarded to them jointly with Becquerel. The French Academy of Sciences had previously honored them with the La Caze prize of 10,000 francs. In 1906 Professor Curie was killed in an accident and Madame Curie succeeded him as professor of physics at the university, the first woman to hold such a position there. In 1911 she received the Nobel prize in chemistry in recognition of her research. The University of Paris later created the Radium Institute and placed Madame Curie at the head of the research department, known as the Curie Laboratory, which she directed actively until a few weeks before her death. During the World War, Madame Curie organized a radiologic service for treatment of wounded at the front. The distinguished scientist twice visited the United States. In 1921 she came to receive a gram of radium, valued at \$100,000, presented to her by President Harding on behalf of American citizens; in 1929 she returned to accept a check for \$50,000, presented for her friends by President Hoover in a ceremony at the National Academy of Sciences. The latter fund she gave to her native city of Warsaw for promotion of research on radium. In 1922 the Academy of Medicine in Paris elected her a member and the following year the French

government voted her a pension of 40,000 francs a year. It was said that she lived humbly in Paris, using her income for the rental of radium. Among honors conferred on Madame Curie in recent years were the Cameron Prize of the University of Edinburgh, a gold medal conferred by the International Congress of Radiology at its Paris meeting, an honorary membership in the Sociedad Española de Física y Química, all in 1931.—(J. A. M. A., Foreign News (July 14) 1934.)

More Radium in Ocean Mud Than in Rocks of Dry Land

More radium exists in the mud of the sea than in the ordinary rocks of dry land, Dr. Robley D. Evans of the University of California has found. His tests show that radium is being deposited constantly by ocean waters.

There is no hope of mining sea mud for radioactivity. Dr. Evans made his experiments merely to test his new method of detecting extremely minute amounts of radium and radon gas emitted by radium. Each ounce of mud contains three trillionths of an ounce of radium.—*Science News Letter*, July 14, 1934.

Spring Fever Really a Disease; Treatment, Cod Liver Oil

Spring fever is not a joke after all, it now appears from latest medical research. It is actually a disease and physicians of the future will have to consider it as such and treat it "conscientiously with irradiated cod liver oil and sunshine, not with the sulfur and molasses of our fathers." This is the opinion of Dr. Joseph T. Smith, physician and assistant editor of the *Bulletin of the Academy of Medicine of Cleveland*.

Spring fever, the disease, is a condition in which the body's stores of calcium are depleted.

"Capacity for work is lowered, physical fatigue easily occurs, and the patient's liability to disease is increased."

Dr. Smith quotes those words from a scientific description of calcium deficiency. But you might have written them yourself as a description of your own state on these first warm days of spring.

A real drop in the amount of calcium in the blood of normal persons during the winter months has been observed by Dr. J. W. Mull of Western Reserve Medical School, Dr. Smith reports, adding the following:

"As the sun rises higher in the sky with advancing spring, in some way the strengthening ultraviolet rays correct this calcium deficiency. Possibly this result is due to the irradiation of the ergosterol, which is a normal constituent of the skin; or possibly the ultraviolet rays ionize the calcium in the tissues so it is more diffusible.

"Whatever the method of their action, it seems true that 'ultraviolet rays are the natural stimulus of that great metabolic organ formed by the living cells of the epidermis'."

Scientific evidence thus seems to add its weight to the natural inclination to get out into the spring sunshine. — *Science News Letter*.

Arctic on Short Rations of Ultraviolet Radiation

Results of the recently concluded Polar Year, in which twenty nations with lands or interests in high latitudes both north and south collaborated in the gathering of geophysical and meteorological data, are beginning to be digested. The major findings will probably be the last to be announced to the public, for they require longest and most tedious labors over the comptometers and sliderules; but in the meantime some interesting facts and figures on conditions in the regions of the aurorae and the midnight sun are beginning to trickle out.

One determination of very considerable practical importance in the everyday affairs of the probably near future is that the Far North is on permanently short rations of ultraviolet radiation. This has been learned from studies of solar radiation conducted at College-Fairbanks, Alaska, by scientists of the U. S. Naval Research Laboratory, under the leadership of Dr. H. B. Maris. It was learned that there is an adequate amount of this physiologically necessary radiation in the Arctic sunlight only when the sun is high in the heavens, and that occurs only during the noonday hours in mid-summer. Summer mornings and afternoon, and the whole days of spring and autumn, are deficient or practically null in their ultraviolet concentration; and of course the long winter night, with the sun either totally gone or at most a feeble glimmer near the southern horizon, is a time of ultraviolet starvation.

When, therefore, we turn our attention to the more thorough exploitation of the natural resources of the Far North, or establish permanent aviation bases or weather observatories there, we must give special consideration to the ultraviolet requirement of the men who will do a right-face on Horace Greeley's advice and "go North." The short-lived gold rushes into the Yukon valley brought their vitamin-deficiency problem in the scourge of scurvy. But most of the gold-seekers soon came out again; they presented no permanent problems such as a long-time occupation of lands of twilight and dark will bring.

The conquest of the North must either be carried on by rotating corps of men who will take turns coming south for sun-soakings, or by equipping them with batteries of ultraviolet sun-lamps, or by making up in their diet for what they lack in direct irradiation. Codliver oil by the quart, as the Norwegian fishermen of the most northerly fjords drink it, may have to become a part of the daily tipple of the men of the "Drang nach Norden." — *Science News Letter*.

Inch-Long Radio Waves Interest Marconi

When Guglielmo Marconi, the father of radio, visited the California Institute of Technology a few weeks ago he was most vitally interested in the experiments of Prof. G. W. Potapenko, who has developed a short wave generator.

Senator Marconi has been using 50 centimeter waves and was delighted to learn from Prof. Potapenko how to generate shorter ones down to 3 centimeters, only slightly longer than an inch. Prof. Potapenko's method has an additional advantage in providing very steady oscillations—an important feature not obtainable by older methods, but necessary for precise measurements.

The reason Senator Marconi wants short waves is that they can be concentrated in a beam like a searchlight beam. This saves energy and makes secrecy possible in wireless communication. To make a reflector for electromagnetic waves such as radio waves or light waves, one needs a mirror larger than the wavelengths. This is easy for light but is inconvenient for any but the very short radio waves.

Prof. Potapenko is not working on communication problems at the moment but is applying his generator to high frequency magnetic and electric experiments. This field is almost unexplored, in spite of the fact that Dr. R. A. Millikan performed some of his earliest work along this line more than 35 years ago. The problem was to find out how the electromagnetic waves are absorbed by the molecules of various substances. Prof. Potapenko has only recently settled the matter and found that the molecules are rotated by the waves and relax gradually to their original position. The energy of the rotation is taken from the waves. When the frequency of waves is above a billion a second much energy is absorbed. This shows that the molecules take less than a billionth of a second for their relaxation time. The bigger molecules are more sluggish than the smaller.

Each Bone Has Own Sound When Tapped, Russian Finds

Every bone has its own distinct sound when it is tapped, Dr. T. J. Arieiev of Leningrad has found. He has proved this by oscillograms taken of several important large parts of the human skeleton. The oscillograms are written records of the sound waves set in motion by the bone when tapped. These written records make possible a much more accurate comparison of the varying sounds of tapped bones than could be obtained merely by listening to them.

The sound of the bones is naturally affected by age, sex, race and individual peculiarities of body build. Whenever there is an inflammation of the bone or it is cracked or broken, the sound undergoes a marked change. This may be readily brought out by comparing the tones of healthy and suspected bones, as practically every bone of the human body has its counterpart, it is claimed.

Dr. Arieiev's observation was pronounced a valuable medical advance by a special committee of health authorities and physicists which was set up to examine his method and results. According to

Prof. A. J. Joffe of the Russian Academy of Science, who was on this examination committee, it is quite feasible to construct a simple acoustical apparatus for investigation of bones which would produce records of sounds, just as an x-ray machine makes x-ray pictures.

Cosmic Rays Supply Most of Energy for Universe

Cosmic rays are the chief source of energy in the universe. From 30 to 300 times more energy is shooting through celestial space in the form of cosmic rays than in all other radiant energy forms combined. This is the conclusion of Drs. I. S. Bowen, Robert A. Millikan and H. V. Neher of the California Institute of Technology, expressed in a communication to the *Physical Review*.

Their estimates of the energy falling on some body millions of light years away from the earth is based on new high-altitude measurements of cosmic ray intensities. They conclude that the energy falling on the earth from the stars is only twice as great as that coming from space as cosmic rays.

The earth is located not far from a huge group of stars that astronomers call our galactic system so that the earth is in a region of highly energized space. A body located in inter-galactic space would receive from 60 to 600 times less star-light than the earth.

The California scientists have taken measurements on the decrease in strength of the cosmic rays as these rays plow through the atmosphere. By adding up all the measured energies over all heights from the surface of the earth to the top of the atmosphere they have obtained definite information on the total cosmic ray energy intercepted by the earth.

The estimates of the density of starlight energy in the universe were made by Dr. S. A. Korff, also of the California Institute of Technology. The uncertainty as to the exact amount depends upon the uncertainty as to the exact number and brightness of all the stars and luminous matter in the universe.

Less Radiation From Sun Forecast for Next Two Years

Sun's weather forecast: Colder for the next two years.

The long-range forecast of the variations of the sun's radiation, announced by Dr. C. G. Abbot, secretary of the Smithsonian Institute, is "solar radiation generally below normal."

This is not a forecast of earthly weather. Dr. Abbot emphatically stated that weather is much more complex than variation of solar radiation "owing to circumstances of mountains, deserts, vegetation, oceans, ocean currents, snow, clouds, humidity, wind, which affect localities differently."

"Yet I am firmly persuaded that the main part of the departures from normal monthly mean temperatures at many localities" he writes in a bulletin of supporting data, "are produced by the seven periodic variations of the sun."

These are intricately woven periodicities of 7, 8, 11, 21, 25, 45, and 68 month periods which he has

discovered as the result of observations and calculations extended over many years.

In making his two-year prediction Dr. Abbot combined the expected curves of each of these periods into one general curve. Two years ago he made a similar prediction with less accurate data, which in general has been fulfilled. The sun, as he predicted, has given off considerably more heat than normal.

Dr. Abbot and his colleagues are working on the problem of applying the solar radiation results to the prediction of temperatures at various inland points in this country.

Liability to Cancer Not Inherited, Rat Study Shows

Liability to cancer as such is not inherited, results of a twelve-year investigation with rats has shown. The studies were made by Drs. M. R. Curtis, W. F. Dunning and F. D. Bullock of Columbia University and are reported in the *American Journal of Cancer*.

The investigations are said to answer the question whether you are more likely to have cancer because one of your ancestors had it.

Chance is an important factor, the Columbia investigators said. Liability to cancer is not carried in the germ cells that carry hereditary traits, such as hair and eye color, it appears from their studies. The only way in which heredity can affect the development of cancer is insofar as it determines whether or not you will have a long life, and whether you will or will not be susceptible to a given irritant. This is because, in the opinion of the Columbia investigators, length of life and irritation are the only two factors responsible for development of cancer.

Dr. Francis Carter Wood, director of Columbia University's Institute of Cancer Research where the work was done, described the experiments and their significance as follows:

"For twelve years these investigators have been breeding white and colored rats and infesting them with a parasitic worm which causes cancer of the liver. Over 26,000 have been so treated and the total number of animals studied is more than 52,000. Of the 26,000 only 3,300 developed cancer.

"The studies of the condition underlying the appearance of this cancer have shown that the only factors in the appearance of the cancer have been the length of the life of the animal and the amount of irritation produced by the worm.

New Treatment Aids Hopeless Cancer Patients; Not Cure

A new treatment for cancer devised by a British physician has given relief to some cancer patients whose cases were called "hopeless." It cannot be called a cure, since it has not been used long enough for physicians to know what the ultimate results will be.

The new treatment reduces pain and discomfort and often enables patients who entered the hospital complete and hopeless invalids to return, for a time at least, to their normal life.

It was devised by Dr. A. T. Todd, physician to the Bristol Royal Infirmary, who reported results with it in the current issue of the *British Journal of Surgery*.

Dr. Todd uses a new medicine known as a sulfur-selenium colloid and another colloid of selenium which is combined with radium substances so that it is slightly radioactive. The first medicine is called SSe for short, and the second is abbreviated as R. A. S.

In a large number of instances the patients treated by this method have become apparently well and are still alive more than a year after the beginning of the treatment, which was little used before 1931. Two cases are alive after 2½ and 4 years, respectively.

Dr. Todd first ascertains that all other types of treatment (surgery, x-rays and radium) have failed, that the diagnosis of cancer is certain and that the patient is willing to cooperate by having regular treatment for a period of years if necessary. He then starts by injecting into a vein 4 cubic centimeters or about 1 teaspoon of SSe. After 48 hours powerful x-rays are trained on the growth.

The doses of SSe followed after 48 hours by x-radiations are given weekly for 8 to 14 weeks. When the position of the cancer is such as to make the patient highly sensitive to treatment the dose is cut in half. By spreading the dosage of x-rays over a longer period than the normal 8 weeks, when necessary, care is taken to avoid too marked a reaction.

After this preliminary course, in which the selenium is gradually ionized, that is, changed in its electrical properties by the x-rays, the regular treatment is begun. For the first three weeks doses of R. A. S. are given at weekly intervals; thenceforward the doses of R. A. S. are given alternately with SSe, each every two weeks. The R. A. S. is believed to act in the same way as the x-rays, though on a much smaller scale, in ionizing the selenium colloid.

Dr. Todd believes this ionization to be an important part of the treatment, which is considered to act as a stimulant to the body's defensive mechanism against cancer, and not to have any direct effect on the growth. He has developed an ingenious theory as to the nature of this mechanism, and considers that cancer is an infectious disease.

If the patient's condition appears to improve, the alternate injections of the two colloids are continued regularly and are stopped only when

the cancer symptoms have disappeared. But when the treatment is unsuccessful the "preliminary" combination of SSe with x-rays is repeated after a three-month interval.

Insufficient time has elapsed to show whether this new method may sometime provide a complete cure for cancers otherwise incurable. — *Science News Letter*, May 26, 1934.

With Electron Microscopes We May Observe the Unseen

By using electrons, particles of electricity, instead of light there is the possibility of building microscopes that will "see" minute objects several thousandths of the smallest size that can possibly be viewed by means of light detectable by our eyes.

The development of electron optics is one of the important achievements of modern physics. In this country and abroad considerable success has been achieved in using magnetic and electric fields in vacuums to bring to a focus electrons in much the same way that mirrors and lenses are used to reflect and refract light.

Dr. C. J. Davisson of the Bell Telephone Laboratories, New York, is a pioneer in this work. In a statement prepared for Science Service and broadcast over the Columbia Broadcasting System he gives one reason why scientists are going to the trouble of building intricate apparatus for producing electron images when perfectly good light images can be produced so much more easily.

"The highest magnifying power worked with microscopes is about 3500," Dr. Davisson explained. "This isn't because microscopes of higher magnifying power can not be made. We could just put one microscope above another if we liked and have a magnifying power of 3500 times 3500.

"Why isn't this done? It is a matter of resolution. The light from a point in the object does not appear as a point in the field of the microscope—it appears as a spot—a very small spot but nevertheless a spot. So that two points in the object, if they are very close together, will produce two spots which overlap and so appear to the observer as one spot. The points in the object are not resolved, as we say, in the field of the microscope. And if we added a second microscope to the first they wouldn't be any better resolved in the field of the second—they wouldn't be as well resolved, in fact. Now the size of these spots, and so the resolving power of the microscope, are determined in part by the wavelength of the light.

WJW

THE STUDENT'S LIBRARY

MASSAGE AND REMEDIAL EXERCISES IN MEDICAL AND SURGICAL CONDITIONS. By *Noël T. Tidy*, Member of the Chartered Society of Massage and Remedial Gymnastics; Sister-in-Charge of the Massage Department, Princess Mary's Royal Air Force Hospital, Halton. Cloth. Price, \$5.25. Pp. 429 with 178 illustrations. Baltimore: William Wood & Company, 1933.

This work offers a concise summary of practically all the affections related to the human economy in which massage and remedial exercises are of benefit. It is presented in non-technical language to meet the educational experience of physical therapy aides, and is intended as a text for senior medical students and those recently qualified to act as medical assistants. That the book is comprehensive in scope — indeed, encyclopedic — is indicated by the tremendous ground covered. In the space of twenty-three closely printed chapters, the author has incorporated in outline form the definitions, physiology, pathology, symptoms and special treatment of fractures of the upper and lower extremities, dislocations, sprains (muscles, wounds, scars), after treatment of injured joints, synovial membranes and bones, diseased and injuries to the brain, nerves and coverings, constitutional, cardiac and gastric affections, blood, respiratory and abdominal organs. The work is generously illustrated with anatomical charts and postural exercises and contains a comprehensive index. The book is a practical contribution to the subjects under review and contains a splendid summary of the most essential methods of treatment, the exposition of which has at all times been presented in clear, concise language. This work promises to become the best thumbed book of that growing group of workers essential in physical therapy practice.

THE ADJUSTMENT OF MUSCULAR HABITS. By Lieut. Col. *James K. McConnel*, D.S.O., M.C., with a Foreword by *W. E. LeGros Clark*, D.Sc., F.A.C.S. Cloth. Pp. 129. Price: 4s. 6d. net. London: H. K. Lewis & Co., Ltd., 1933.

Maladjustment of muscular habits following trauma and other pathologic changes is still a problem of no small difficulty with the profession. The effort to readjust and to reeducate the vast group of patients within this category has long occupied the attention of medical practice, but, despite efforts toward its alleviation, the results have been anything but gratifying. This work must therefore be seriously considered, not only because it offers an intelligent approach, but because it presents the entire or rather the salient features of this branch of medical practice in a light that holds out promise of more certain control of muscular habits. As explained in the foreword it is generally recognized

that the harmonious interaction of muscles is influenced not only by the integrative action of the central nervous system, but that with the intervention of mental and physical disturbances, defective changes in muscle balance provoke a host of symptoms classified as myalgia, neuritis and arthritis. Serious consideration must therefore be given to a work such as this which stresses the physical and psychological aspects of bad muscular habits. The book contains a laudatory foreword by Professor Le Gros Clark, Anatomist at the St. Thomas' Hospital Medical School, which concisely points out the value of McConnel's work to the physical and psycho-therapist. According to the author, many of the ideas contained in his book "arose while treating patients in the Electrotherapeutic Department at St. Thomas' Hospital" where he obtained ample opportunity to observe "patients with various complaints getting on and off plinths and chairs." The contents are divided into a foreword, a preface, eight chapters and an index, containing desirable information of value to the physician, surgeon, or specialist. The entire thesis is practical in its objective, attempting to "describe a technic which can be readily applied to patients through the usual channels without special courses of instruction." The ideas embodied in this work are undoubtedly those of an advanced student of the subject and hold out much promise for good. The book should therefore be in the hands of all interested in this phase of medical practice.

INFECTIONS OF THE HAND. A GUIDE TO THE SURGICAL TREATMENT OF ACUTE AND CHRONIC SUPPURATIVE PROCESSES IN THE FINGERS, HAND AND FOREARM. By *Allen B. Kanavel*, M.D., Sc.D., Professor of Surgery, Northwestern University Medical School; Attending Surgeon Wesley Memorial and Passavant Hospitals, Chicago. Sixth Edition. Cloth. Price, \$6.00. Pp. 552 with 216 engravings. Philadelphia: Lea & Febiger, 1933.

The foregoing work has long been regarded as the classic in its field, having established its authority on the basis of the best scholarly exposition on the subject of infections of the hand. That this is a fact generally recognized is illustrated by the numerous editions through which it has passed, a situation which gave the author succeeding opportunities to revise and add to the data on the subject. The present edition has permitted Kanavel to thoroughly revise and enlarge the scope of this substantial contribution and has afforded him the means to incorporate his most recent experiences of his studies regarding hand infections. In its present form it covers not only the anatomy, pathology and treatment of infections, but incorporates new material on infections originating from bites,

from unusual injuries related to the pathology and treatment of meta-carpo-phalangeal infections of the joint, gangrenous infections, and other peculiar forms. One also notes new chapters on the functions of the hand and discussions of splints and the prophylactic treatment of injuries. Practically, each chapter shows some revision in order to bring its material down to date. Even the arrangement of the text has been reclassified for purposes of clarity and simplification. Anatomy and experimental data have been separated from clinical studies, bringing the diagnoses and treatment of the various clinical affections of the hand into proper sequence. The generous illustrations add to the clarity of work. Incorporated in the text is a splendid and well balanced discussion of the value of physical and occupational therapy, methods which the author extols in relation to the after care of patients, to maintain and restore function. In its latest form this book is indispensable to surgeons as well as to those engaged in the practice of traumatic medicine and surgery.

THE PRACTICAL MEDICINE YEAR BOOKS. THE 1933 YEAR BOOK OF GENERAL THERAPEUTICS. Edited by *Bernard Fantus*, M.S., M.D. Cloth. Pp. 464. Price, \$2.25. Chicago: The Year Book Publishers, 1933.

This volume is replete with therapeutic nuggets of a high order. To use a trite expression, this

year's book on General Therapeutics is bigger and better — bigger and better not only in the sense of size and quality, but rather in its scholarly survey of the newer contributions of value to our therapeutic equipment. While in general experience nuggets are usually obtained by luck or labor, in the present instance, the reader is presented with an array of predigested facts that for possession requires no greater an effort than the perusal of this excellent work. Indeed, this volume is exactly what the editor suggests — "a feast exceptionally replete with good things therapeutic." The subject matter is loosely divided under seven headings: "Therapeutics in General," "Antipathogens" (Amebicides, etc.), "Restoratives" (Oxygen, iron, diet, etc.), "Tissue Alterants," "Function Modifiers," "Toxicology," and "Physical Therapy." Special note is made in the preface regarding some of the newer and important advances in therapeutics. Thus attention is called to the interpretation of inflammation and the vasodilating action of histamine and analogous H-bodies; to the value of human wastes, i. e., placental blood and tissue, urine in pregnancy, and the blood of cadavers; to status of the anemias, to glycocoll as a diagnostic means in myasthenia, to dinitrophenol as a metabolic whip; to the value of red rays (neon), etc. Mention is but made of the foregoing subjects to indicate the wide range and trend of discussions presented in this volume. Every progressive physician will find this an invaluable investment.

(Continued from page 428)

One risks losing patients because the technician gives that personal attention which the patient expected from his doctor. It is suicidal to say to a patient with a pain in the back, "go to so and so and get a good baking and massage." Such care should be afforded in the doctor's office, right then and there, and under proper supervision. There are cases of backstrain due to French heels, to a sacro-iliac sprain, or

to partial refrigeration of the body. An independently practicing technician might differentiate between the three conditions and perhaps give the right treatment, but in any case, the patient would be gone anyhow and never return because the patient would think that the masseuse knew more than the doctor. Therefore we should make more use of massage in our own offices and under our own personal control.

34 East 32nd St.



INTERNATIONAL ABSTRACTS

Diathermy and Regeneration of Bone. E. David Weinberg and Grant E. Ward.

Arch. Surg., 28:1121, (June) 1934.

The authors conducted this experimental study on normal dogs. Both fore legs were fractured under strict aseptic conditions and one leg treated by diathermy while the other acted as a control. They found through this carefully conducted series of experiments that diathermy properly applied will raise the temperature of bones and muscles. The rise of temperature increases the local circulation, and such increased physiologic activity accelerates the formation of new bone.

Copper Ionization for the Treatment of Leucorrhea in Virgins. David William Tovey.

A. J. Obst. and Gynec., 27:916 (June) 1934.

During the past two years Tovey treated leucorrhea in twenty-five (25) virgins, from fifteen to twenty-five years of age with very satisfactory results. He employed the following technic: A special speculum was used consisting of a cystoscopic tube with a handle large enough for the patient to hold. With the patient well down on the table the instrument was introduced and the cervix exposed and swabbed. A small sized copper intracervical electrode was inserted up to the internal os. An indifferent electrode was placed under the back, and from 40 to 10 ma. of current were given with the positive pole. After twenty-five minutes the current was turned off and the negative current was used to release the copper electrode. From 4 to 8 treatments were necessary to cure cervicitis. The treatment was painless.

Climate and Quartz-Lamp.

The Brit. J. of Phys. Med., 9, (June) 1934.

Discussing in Acta Davosiana, Jan., 1934, the high-mountain climate of the Rhaetian Alps (5,000-6,000 feet) and laryngeal tuberculosis, Th. Ruedi, Davos, states that very favorable results, obtained by combination of the Davos climatic cure, with quartz-lamp therapy, were observed in two cases of pharyngeal tuberculosis; one a diffuse nodular process with localized ulceration; the other, resulting from an apical pulmonary infiltration, an acute metastasis in the epipharynx,

the lateral cords, the tonsils and the vestibulum laryngis, in a woman at the end of the eighth month of pregnancy. This patient is still under treatment, but the improvement of the metastatic infection, accompanied by marked improvement of the pulmonary disease, and the general good condition point to a complete cure. The simultaneous spread of the tubercular infection in pharynx and larynx makes this case a notable exception.

The Posture Problem Up to Date. May Goodall Raddow.

Good posture is an active process, both physical and mental, and the result of a counterplay of many reflexes, and governed by many cross pulls and leverage power. Without this active process the body is liable to more or less vertical collapse.

Exercises for direct effect upon the spinal supports are the first necessity until good posture becomes a habit.

The old order of "Hips and shoulders forced backward to make a nice curve in the middle of the back" is obsolete and must be run to ground!

The approved methods work for the development and control of intrinsic versus surface muscles. Localized control is the first aim, strength will follow. The first effect of stiffness and rigidity will give way to ease and grace as the muscles become strong and well toned. The student is then ready to carry these fundamentals into sports, skills and aesthetic work of every kind and are guaranteed to lead to proficiency.

The usual weak centers of the body, namely, the lower back, neck and midspine regions are weak because they bear the stress and strain in the control of the whole body. These points, then, should receive first attention to make them the strongest points instead of the weakest.

Arm movements should be independent of shoulder-blade control.

To gain industrial efficiency there must be an adjustment of the machine, coordination of the various factors to produce the manufacture and expenditure of energy with the minimum of output; so in the body, the muscles which are the storehouse of energy, should be kept in condition which will best give the "carry-over" from class to life habits, a condition deplorably lacking in most systems in current use.

The generality of weak-spined humanity is sadly out of plumb and requires revolutionary tactics to rescue conditions of more or less disability. The fundamental keys to central control of the body which have been outlined give a feeling of conscious power and strength which leads to encouraging results. — (Abst. author's monograph, 1933.)

Electrocoagulation of the Melanoma and Its Dangers. Philip D. Amadon.

Surg. Gynec. and Obst., 56:943, (May) 1933.

A series of 27 cases of melanoblastoma of the skin was reported a short time ago at which time one was disappointingly impressed with the failure of our existing methods of treatment. The treatment of these melanotic growths by the popular use of the "electric needle" disclosed several facts which led to this study. In the series studied, those cases treated by electrocoagulation showed a 100 per cent recurrence at the site of the primary, with early regional and generalized metastasis in the majority of cases. The untreated melanoblastoma progressed less rapidly to local and general metastasis than those electrocoagulated. The average time for the appearance of regional metastasis in the cases so treated was 5 1/7 months and 11 1/2 months for generalized metastasis. The author draws the following conclusions:

1. The cases of malignant melanoma in a series of 27 cases treated with the electric needle showed a 100 per cent recurrence.

2. Electrocoagulation of a group of senile keratotic lesions demonstrated the escape of "tissue gas" into the peripheral visible venules under pressure.

3. An application of this discovery to electrocoagulation of malignant melanoma renders plausible the explanation of high recurrence on the basis of the mechanical forcing of unstable malignant cells more widely into the tissues by pressure exerted in the lymphatics and vessels by generated "tissue gas."

4. Preliminary encircling of the primary growth with the electric needle through apparently healthy tissue is unsound as the fascial lymphatics wide of the primary lesion may be filled with tumor cells, the same phenomenon of generated "tissue gas" pressure occurring here with similar results.

5. Inefficient treatment of benign skin lesions, especially the benign melanoma with the electric needle, may initiate malignant change by acting as an irritant or by the implantation of potential chromatophores into the subcutaneous tissue.

6. Surgical excision of these lesions with special reference to the anatomy and mode of metastasis, remains the procedure of choice.

Physical Therapy in Gynecological Office Practice. Virginia Tannenbaum.

N. Y. State J. Med., 33:647, (May 15) 1933.

Medical diathermy is of value in the treatment of specific acute, specific subacute and some forms of specific chronic salpingitis. Medical diathermy may be of value in the treatment of tuberculosis of the pelvic adnexa.

Surgical diathermy offers a decided advance in the treatment of diseases, specific or otherwise, of the cervix and cervical canal.

Sunlight and ultraviolet rays, because of their

effect on the human organism, are of benefit in the treatment of some types of dysmenorrhea.

A New Method of Radiotherapy in Leukemia. G. Marchal and L. Mallet.

Bulletin et mémoires de la Société médicale des hospitaux de Paris, 49:737, (June 12) 1933.

Marchal and Mallet describe a new method of Roentgen-ray treatment of the leukemias, first used by Teschendorf in 1929-1930. The principle of the treatment is to irradiate large fields, or the entire body, with small doses of hard x-rays. As the authors consider that there is a definite risk in irradiation of the entire body in a single treatment with present equipment, they have adopted the following technic: 200,000 volts, 3 milliamperes, 1 mm. copper + 2 mm. aluminum filtration; distance, 1.70 to 2 meters; two fields, 1 meter in diameter, anterior and posterior, are given a dosage of 25r each at one treatment, a total dosage of 50r; two or three treatments are given weekly until the entire body has been treated. The duration of treatment varies in each case; repeated series of treatments are given as indicated. The authors are seeking to develop a safe and satisfactory method for irradiation of the entire body at one treatment. They have treated 6 cases of leukemia with this method and have found that the disease can be controlled and the symptoms relieved to better advantage than with the usual methods of radiotherapy, without causing severe anemia, without injury to the skin, and without developing radioresistance. — Med. Times and L. I. Rec., 59, (Sept.) 1933.

Irradiation in a Case of Osteogenic Sarcoma: Recovery. Sherwood Moore.

Surg. Gyn. and Obst., 56:681, 1933.

Intensive irradiation in an early case of osteogenic sarcoma may result in recovery (ten years). Young persons react more favorably to the effect of intensive irradiation in their tissues, which soon return to normal and remain so permanently. Exploration and biopsy are possible in this disease without necessarily incurring much danger of spread and Metastasis. — J. P. I. M. Assor., 13, (Sept.) 1933.

Transurethral Prostatic Resection. William P. Garshwiler, Arthur F. Weyerbacher, and James F. Balch.

Urol. and Cutan. Rev., 38:413, (June) 1934.

The authors have studied the functional results, the post-operative morbidity, complications, failures of operation and mortality rate associated with transurethral prostatic resection and arrive at the following conclusions:

1. Transurethral prostatic resection is a distinct advance in the management of bladder neck obstructions, but should be used in selected cases. It is conceded that median fibrotic bars, carcinoma of the prostate, middle lobes, and the smaller lateral lobes are ideal for resection. The

larger hypertrophies, especially lateral lobe involvement, should be subjected to surgical prostatectomy.

2. Functional results have been very gratifying in our cases, with the exception of a few enormous lateral lobe hypertrophies.

3. Post-operative morbidity and complications have been conspicuously few and very mild. We have noted many more complications during preparation, with catheter drainage, than after resection.

4. Our mortality has been two per cent in the above series. No fatalities have occurred since.

Mitogenetic Radiation in Cervical Carcinoma. J. Klenitzky.

Ztschr. f. Krebsforsch., 39:60, 1933.

As most of the experiments on mitogenetic radiation from cancer have been carried out on tumors removed from the body and reduced to paste, the author has investigated an easily accessible growth *in situ*—carcinoma of the cervix uteri. In 14 certified cases the rays could be demonstrated; however, they were equally strong in 8 patients with benign glandular erosions.

The blood of these 14 cancer patients was inactive, but so was that from 3 of the non-cancer cases; hence, as Gurwitsch has said, the disappearance of mitogenetic radiation from the blood, while a constant feature of carcinoma, is by no means limited to this disease.

As a supplement to this investigation, Klenitzky examined the blood of 7 patients with cancer of the skin. Radiation was evident in two, so that canceroid would appear to be an exception to the general rule for carcinoma.

The author closes with a preliminary report on the mitogenetic activity of mouse blood after total ablation of an Ehrlich carcinoma. In 10 mice inoculated with this growth radiation ceased entirely a few days later. The tumor was then removed, but recurred in 9 animals; in the tenth, which was still free of recurrence when it died six months later, mitogenetic radiation set in again about a week after the operation and increased steadily in strength.—A. J. Cancer, 19, (Oct.) 1933.

End Results in Prostatic Resections. A. E. Goldstein, and M. J. Herschman.

Urol. and Cutan. Rev., 38:410, (June) 1934.

The authors arrive at the following conclusions:

1. From a standpoint of end results we have not met with the same success that we have had in our cases where prostatectomy was performed.
2. There was a direct operative mortality of 10 per cent.
3. Five of the six deaths occurred in the poor surgical risk class.
4. In poor surgical risks we have been enabled to operate upon eighteen cases who in all probability would not have been able to stand the surgical shock from an open major operation.

In other words thirteen, or 72.2 per cent of these cases are now living and comfortable without leading a catheter life.

5. Complications were far in excess of those encountered where the open operation was employed.

6. Pyelonephritis is the complication most frequently encountered and causes a great deal of concern when present.

7. Our best results were obtained in cases of contracture of the vesical orifice and median bars.

8. The results obtained in types of cases other than those mentioned in No. 4 and No. 7 are not sufficiently satisfactory to warrant the risk that the patient incurs.

Influence of a Carcinogenic Agent 1 : 2 : 5 : 6 — dibenzanthracene on the Respiration of the Normal Cell. Y. Pourbaix.

Compt. rend. Soc. de Biol., 112:1222, 1933.

1 : 2 : 5 : 6—dibenzanthracene, even in minute amounts, depressed in general the respiratory activity of liver from normal five-week-old guinea-pigs, as measured in a Warburg apparatus.—A. J. Cancer, 19, (Oct.) 1933.

Should All Prostatic Obstructions Be Resected? A. H. Peacock.

Urol. and Cutan. Rev., 38:405, (June) 1934.

Urologic surgery has its fads and succumbs to the national trait of catching hold of an idea and riding it hard for the time at least. The procedure has now been in vogue long enough and a sufficient number of cases have been collected to give us a fairly good composite picture of our results. They are:

1. The punch or loop resection is a permanent addition to urological surgery.
2. It is adapted to at least 75 per cent of all prostatic obstructions.
3. Punch or loop resections should not be attempted on all obstructions of the internal vesical orifice.
4. Huge prostatic enlargements, markedly infected prostates and intraurethral prostatic lobes, can be better managed by a surgical prostatectomy.

Prostatic Resection — Its Comparative Evaluation. Robert V. Day.

Urol. and Cutan. Rev., 38:397, (June) 1934.

The author asserts that after a complete and critical evaluation of the advantages and disadvantages of prostatic resection, it will be found the method under discussion offers a permanent advance in the matter of dealing with prostatic obstruction. While at present the pendulum has swung toward excessive enthusiasm, due to high powered propaganda, there is nevertheless a valuable stratum in this procedure to ensure it a

permanent place in urologic surgery. The author evaluates his experiences in the conclusions:

1. Prostatic resection as developed during the past three years has enormously widened the field of transurethral surgery.

2. Since it is spectacular and in the beginning seemed so simple and so innocuous to the unwary, the result was widespread publicity even amongst the laity. The laity therefore demanded it, even those with incipient prostatic hyperplasia, who would have fared better if left alone for the time being.

3. Great gains have resulted from resection methods selectively employed, and we should encourage its use but not its abuse.

4. Fifty to 65 per cent of adenomatous prostates fare better after prostatectomy than after resection and the mortality rate after prostatic enucleation in comparable circumstances is certainly no greater — probably less.

5. The post-resection morbidity and the deaths occurring during the succeeding six months stamps indiscriminate resection as unsound practice.

Further Observations in the Treatment of Prostatic Hypertrophy by Transurethral Resection.
Charles Pierre Mathé.

The Urol. and Cutan. Rev., 38:381, (June) 1934.

The author arrives at the following conclusions with the reference to transurethral resection of hypertrophied prostates.

1. Resection deserves a firm place among the operative procedures on the prostate gland. It has come to stay and its indications have been fairly well defined and now include about 80 to 90 per cent of all cases suffering from prostatic hypertrophy. When properly performed it will always give satisfactory and lasting results in cases suffering from collar type fibrotic hypertrophy, atrophic sclerosis, moderate median and lateral lobe hypertrophy. It also affords palliative relief to the poor risk presenting the larger hypertrophy or carcinoma of the prostate in which open operation is contraindicated.

2. It does not supplant prostatectomy which should be performed on patients presenting massive hypertrophy and the spongy bleeding type. Prostatectomy should likewise be employed in all cases in which instrumentation is hazardous by reason of a severe reaction on the part of the patient or because of urethral stricture, pathological deformity of the anterior and posterior urethra and marked contraction of the bladder. Open operation is also indicated in cases in which there is complicating diverticula and huge stones of the bladder and in those in which it had been necessary to perform cystotomy.

3. Transurethral resection of the prostate is a highly technical procedure that is difficult to learn and can be performed skillfully only after the development of proper technique. In skilled hands, uniformly good results have been obtained and in these the mortality has proved to be lower than in prostatectomy. It has given us satisfactory results in cases which we have selected for it which now comprise about 85 per cent of all prostates coming to us for relief.

A New Method of Producing Heat in Tissues: The Inductotherm. J. R. Merriman, H. J. Holmquist, and S. L. Osborne.

Am. J. M. Science, 185:677 (May) 1934.

A new device, the inductotherm, for producing heat in tissues by electromagnetic induction is described. Its heating characteristics are such that maximal heat is produced in the more conductive or more vascular tissues rather than in the less conductive or more adipose tissues. The inductotherm for local or general treatment requires merely the placing of a few turns of flexible insulated cable around or about the part to be treated. Clinically, the inductotherm meets the requirements of the field of medical diathermy including the production of hyperpyrexia. From the viewpoint of efficient heating, ease of application and comfort of the patient, the inductotherm should become an important clinical method of applying heat in the tissues.

MUSCLE TRAINING AND REEDUCATION EXERCISES IN ANTERIOR POLIOMYELITIS *

LE ROY HUBBARD, M.D.

Director of Extension

The Georgia Warm Springs Foundation

WARM SPRINGS, GA.

Anterior poliomyelitis is an acute infectious or communicable disease, which may or may not be followed by paralysis or weakness of one or more muscle groups. Its cause is a specific micro-organism which belongs in the class of filterable viruses, i.e., ultra-microscopic in size, which easily pass through an earthenware filter. These viruses are the cause of many diseases common to man and animals, and though they may not have been isolated, their action is fairly well known.

The virus is said to enter the body through the nose and throat, travel along the course of the olfactory nerves, and reach the central nervous system, particularly the lower brain and the anterior horns of the gray matter or motor tract of the spinal cord. The organism is discharged from the body in the secretions of the nose and throat, and this constitutes the principal, if not the only, source of infection.

The disease is endemic in practically every state in the Union; sporadic cases are occurring all the time, and any community may have an outbreak which will develop into an epidemic. These outbreaks or epidemics occur most frequently in the summer or early fall.

It is believed that there are as many, if not more, cases of the non-paralytic type, occurring constantly, than those with definite paralysis or muscle weakness. In the former the virus affects the body generally and does not penetrate deeply the central nervous system. Many of these cases are not recognized and probably, in connection with healthy carriers, are largely responsible for the continuance and spread of the disease.

While it is possible to contract anterior poliomyelitis through infected raw foods and possibly other sources (several milk

borne epidemics have been observed and reported), this happens rarely, the principal method of infection being by contact. This may be direct or indirect.

Examples of direct contact would be coughing or sneezing of an infected person into the face of another, or the direct transference of an infected object from the throat or nose of one to another. Indirect contact might come from the smearing of the nose or throat discharge on some object which was subsequently handled by a healthy individual, and thence transferred by the hands.

One attack confers immunity, hence second attacks are extremely rare. It has also been discovered that immunity exists among children and adults where there is no history of an attack. This immunity is probably acquired in one of two ways: either a mild unrecognized attack or a gradually built up immunity through exposure. It is likely that this, which might be termed natural immunity, is the reason why there are not more cases in epidemics as the exposures are very great. It is thought by some observers that a general immunity is being established in this country which may result in a decline in the number of cases in the future.

Up to the present time, we have no definite means of establishing an artificial, permanent immunity and thus preventing outbreaks, but experiments are being conducted along that line with some hope of success. Also, we have no sure means of preventing paralysis of the muscles after the infection has once entered the body, or of checking its progress.

Importance of Early Treatment

Treatment in the acute, the early convalescent, and the later stages is therefore most important. While it is true that some cases will recover from paralysis, either partially or completely, without any special

* Read at the Spring Session of the Eastern Section of the American Congress of Physical Therapy and the New York Physical Therapy Society, New York, April 7, 1934.

treatment or in spite of unscientific treatment, there is no doubt that in the majority the end result will depend upon the treatment from the onset.

When the virus has entered the body and travelled along the course of the olfactory nerves it invades the central nervous system and particularly the anterior horns of the gray matter of the spinal cord and the motor nerve roots, and causes an inflammation with resulting edema and swelling around the blood vessels and consequent pressure on the motor cells. This produces loss of function and consequently weakness or paralysis of those muscles supplied with motor power by those cells which are situated in the regions of the infected cord. If the inflammation is mild and the pressure moderate and soon relieved, the loss of function may be only temporary, but if atrophy or destruction of the motor cells occurs the loss of muscle power is greater and more permanent.

In the treatment of a case of anterior poliomyelitis there are three objectives:

1. To relieve the congestion and edema of the cord and the pressure on the nerve cells as quickly as possible.

2. To keep the muscles in the best possible condition so that, when and if, the nerve function is restored they will be able to function efficiently.

3. By the use of exercises, muscle training, and reeducation to further increase nerve and muscle function.

The first and second objectives are best attained by a fairly long period of absolute rest in bed, and by supporting with some form of effective apparatus the paralyzed limbs in such positions that the weak muscles are not stretched and the stronger ones contracted.

In the acute and early convalescent stages rest should be absolute and complete and the patient should be moved as little and as seldom as is possible. There is no definite rule by which one can decide how long the rest period should last in any individual case, but it is much better to prolong it beyond what may be absolutely necessary than to begin active treatment one day too soon. An additional reason for this rest period is because, in most cases, there is, in addition to the local loss of muscle function, considerable general nervous shock

and prostration. This is particularly noticeable in the older children and adults.

Massage may be employed to help the circulation and improve muscle tone, but not until all tenderness of muscles and joints has entirely disappeared. It should be very light in character, for too deep or vigorous massage may destroy the soft and weakened muscle fibres. Use of heat, both local and general, is of value, not only to keep the patient warm, but also to relieve pain and tenderness and improve muscle tone.

I am confident that if the plan which I have so briefly outlined is followed in practically every case, the nerve cells and trunks and the muscles will be in a better condition later to respond to treatment by means of exercises, training and reeducation than where active treatment is begun too soon. During this rest period of several weeks there is usually a restoration of some nerve and muscle power in some of the groups, and it is advantageous to wait until this has taken place before starting active treatment with exercises.⁴

Exercises

In order to know the character and amount of exercise to be given to each set of affected muscles, it is necessary to first make a complete muscle examination with a grading and chart of each muscle group.

The grades commonly employed are six in number: zero, indicating total paralysis; trace, denoting contraction of muscle fibre without motion, poor, meaning movement without resistance; fair, movement against moderate resistance or gravity; good, movement against strong resistance and normal. Plus and minus signs may be used to indicate power intermediary between the primary grades. These gradings are not mechanically accurate, and two persons with equal training and experience will grade the power in the muscles somewhat differently, but they will be generally sufficiently accurate for practical purposes.

Re-examination should be made at regular intervals to determine gain or loss of power. The charts are important, not only as guides to the character of the exercises, but as records of the progress of the case, and to determine when changes in the exercises are advisable.

To be efficient in increasing nerve and muscle function, the exercises should not be passive and general, but active and specific. Each muscle group must be exercised separately in accordance with its special function and with the cooperation of the patient and a definite employment of will power to perform the movement. The objective is not only to activate the muscle fibres but to stimulate the weakened nerve cells, and possibly to excite to action dormant cells and enable them to take up the work of those which are atrophied or destroyed.

The exercises should be given on a smooth, firm surface, using talcum powder to reduce friction, with the patient in a reclining position, relaxed and able to see clearly the part on which the operator is working. There should be no disturbing outside influences. The best results are obtained where there is perfect accord between the patient and operator. Personality is an important factor, and at Warm Springs we frequently found it advisable to change the physiotherapists in order to obtain better cooperation on the part of the patient. Many patients will do better work some days than others, just as a trained athlete will one day make a record performance and a few days later, while apparently in the same physical condition, fall far short of his previous effort.

The exercises should be performed very slowly with an appreciable interval between the movements in order to give the patient time to concentrate. It must be remembered that these exercises for weak nerves and muscles are comparatively as strenuous as the usual training exercises for normal individuals, and fatigue can produce more damage in the former than the latter. In general, each exercise consists of ten movements, but the last movement should be done as well as the first, and if signs of fatigue appear, the number should be made less.

About ten years ago Dr. Charles Lowman of Los Angeles, California, began the experiment of having the exercises done in warm water, and established what he termed his under water gymnasium. This was followed three years later by the Georgia Warm Springs Foundation at Warm Springs, Georgia, employing the

natural water of the Springs for this purpose. Since that time nearly every institution where the after care treatment of anterior poliomyelitis is carried on has added a pool, tank, or special form of tub to its equipment.

It was found out that the exercises can be performed easier in water on account of the elimination of friction and gravity, with less fatigue, and for a longer time than on the tables, and also that special methods of exercise can only be done in water. Patients appear to enjoy under water exercises more than above water and hence a psychological factor is added which is of great value especially among the older patients. Nerve and muscle development, training and reeducation by means of exercises is a long, slow process, requiring painstaking cooperation and effort on the part of both patient and operator; but the results obtained in the majority of cases are quite worth while.

The question is frequently asked for how long may improvement be expected, and how long should treatment by exercises be continued? A general answer to those questions is impossible. The statement that no improvement may be expected after two years from the onset, and active treatment might as well be abandoned has been proven many times to be untrue; and, as a result of a rather long experience in observing a large number of patients, I am convinced that there is no absolute time limit for improvement if treatment can be carried on. Unfortunately, in many cases, financial and other circumstances will not permit this, and we have to be content with less than we hoped for and could reasonably expect were the conditions different.

For long standing cases, where there is not much hope of actually increasing muscle power, much can be done to train the muscles to work to better advantage. They can be taught to walk better and more easily, to climb steps, get into and out of chairs without assistance and to do many other things which they have thought impossible.

While there probably always will be a few cases in which the destruction of nerve cells is so severe and extensive as to prevent any hope of much muscle function and they will remain very helpless, fortunately the percentage is small, and I am convinced

that 90 per cent or more of those who can have long and skillful treatment will recover sufficiently to be able to lead useful and happy lives.

149 Chester St., Mt. Vernon, N. Y.

Discussion

Dr. J. B. Nylin (Philadelphia): The great value of hydrogymnastics in the treatment of infantile paralysis is beyond dispute. That this young member of the therapeutic family has developed so rapidly that today, only a few years after its birth, it constitutes a most important factor in the treatment of infantile paralysis is due chiefly to the ingenious work of Dr. Hubbard, and of Dr. Lowman of Los Angeles.

In the treatment of infantile paralysis we must bear in mind that the muscular weakness is due to a destructive process of the anterior horn cells with a more or less complete obstruction of the passage of voluntary impulses to the affected muscles. Our chief endeavor must, therefore, be directed to a functional restoration of those deceased anterior horn cells which have escaped destruction and to the reopening of those more or less blocked nerve paths, as to enable the affected muscles to respond to the patient's will. Therefore, the only means whereby this restoration of function can be attained is by voluntary movements. The element of rest, however, is also a factor of great importance during the whole course of treatment, especially so in the early stage of the disease, the stage of muscular tenderness, where all attempts at movements are absolutely contraindicated. With the passing of this stage active physical therapy begins.

Heat and massage are valuable adjuvants in the neuromuscular reeducation in infantile paralysis, since they stimulate circulation, and thereby increase nutrition and removal of waste products. They also make the muscles and joints more supple, and hence, pave the way for active exercises. Passive movements are beneficial chiefly as a means of stretching contracted muscles and of enlarging the range of movements. Neither heat, massage nor passive movements, however, are *per se* sufficient to re-establish either partially or wholly the lost neuromuscular function. To obtain this result *active*, i. e., voluntary movements are necessary.

The physical characteristics of water make it a singularly suitable medium in which to perform exercises for neuromuscular training and re-education in the treatment of anterior poliomyelitis. The warm temperature of the water in the pools used for this purpose surrounds the body completely and the friction of the water on the moving part of the body acts as a gentle effleurage. It should be noted that the supply of warmth and friction is continuous throughout the duration of the exercises in contrast to those out of the water where heat and massage of necessity must precede the exercises and in which the effect of the heat and massage are apt

to be somewhat lessened during the following period of active motion. The buoyancy of water facilitates the performance of active exercises when the movements are made in an upward direction, while a resistive effect is produced to movements in the opposite direction. A similar, although less pronounced resistance, is offered by the water to lateral movements. This resistance is much smoother than the resistance given to movements out of water. Another great advantage of water as a medium for active movements is that it enables the patient in a recumbent position to turn his trunk symmetrically on a central axis. Finally, neuromuscular re-education exercises in water have a beneficial psychic effect on the patient. The comfort derived from the warm water and the ability to perform voluntary movements with the aid of the buoyancy of the water must surely have an encouraging effect on the patient's morale, an element of great importance in all neuromuscular training.

I wish it were possible to have each of our hospitals provided with a hydrogymnastic pool. It was the intention to add such a pool to our physical therapy department of the Hospital of the University of Pennsylvania, but, unfortunately, the financial depression prevented its realization for the time being. We have, therefore, resorted to the use of a large tub, six feet long, four feet wide, and 2 feet deep. For the treatment of infantile paralysis in small children this tub has proven to be a fairly good substitute for a pool. For these tiny youngsters a tub of the size mentioned is large enough for all movements with the exception of the simultaneous abduction of both arms. The results obtained have been sufficiently satisfactory to justify the employment of a large tub when a hydrogymnastic pool for one reason or another is not obtainable. On the other hand, in the treatment of large children and adults, the tub is for obvious reasons practically useless.

Dr. Heinrich F. Wolf (New York): The paper of Dr. Hubbard was very interesting indeed and illustrates what we may call by the general name of "aiding exercises." Though these have never been used as extensively and systematically before it should not be forgotten that baths have been recommended under the name of kinetotherapeutic baths for many years, not only in the treatment of poliomyelitis but in all cases in which the dominant symptom was muscle weakness, particularly of nerve origin. In the Mt. Sinai Hospital we are using these treatments extensively in myelitis as soon as the acute symptoms have subsided.

We must, of course, use bath tubs either of the ordinary type or the permanent bath. The assistance which the patient gets and which facilitates his active motions has an effect not only on the return of motion but exerts a favorable psychological influence which must not be underestimated.

POLIOMYELITIS *

(A Personal Experience)

ROBERT DWIGHT BROWN, M.D.

HAMMOND, INDIANA

This, as indicated in the title, is the record of a personal experience.

On March 25, 1928, being then 54 years of age, I took sick. By night, I was quite sick, and called in one of my colleagues for help. He diagnosed my symptoms as influenza, and I agreed with him. The question of infantile paralysis never entered the mind of either of us. I had never seen an acute case, though I had while in the Veterans' Bureau, treated a number of cases of the resulting paralysis.

After several days of relatively high temperature, with some delirium and a good deal of pain in my hips and legs, I awoke one morning free of fever and learned that both legs were paralyzed. I did not find out until later, just which muscles were involved. All I knew was that I could not lift either foot off the bed, and if spread apart, I could not bring them together. I could raise my knees by much effort, but my feet would just drag along. Then I would have difficulty in getting straightened out again.

On the 13th day I was able to be out of bed. I found I could stand, but could not walk. I invested in a pair of crutches, and had an interesting time learning to use them, thereby disproving the old adage, "You can't teach an old dog new tricks."

By this time I had rather funny-looking legs. The quadriceps extensors had atrophied, there were longitudinal grooves in place of the adductor muscles, and my glutei maximi had almost disappeared. In fact, for several months I had to wear suspenders, because my belt strap could not support my trousers.

In the meantime, I had consulted several neurologists, in Washington, where I was living at the time, and the consensus of opinion was that I would never walk again. One, in fact, sympathetically told me that I would gradually lose what little use I had of my legs. It happened that this neurologist, who occupied the same rank as I, lieutenant colonel in the Medical Reserve of the Army, met me

at training camp four months later, and when he saw me walk as well as he did he appeared to be chagrined, either because of his dogmatic prognostication, or because I had not lived up to routine experience.

Treatment

As soon as the paralysis was discovered I began taking hot packs, administered by my wife, who is a graduate of the Battle Creek Sanitarium. From my waist to my toes I was wrapped in a blanket wrung out of hot water. I do not know the exact temperature, but at the time it felt within reach of the boiling point. Sensations, however, are unreliable, especially when you are the victim of your own prescription. Then a number of quart bottles of hot water were packed around me, a heavy blanket spread over all, and so steamed for 40 minutes. The bottles were then removed, and after 10 minutes, the top blanket was taken off, and at the end of the hour the original hot blanket came off, I then received a very gentle massage to both hips and legs, followed by very slow passive motion. This was repeated twice a day. In addition, for 30 minutes twice a day, radiant heat was applied to the lumbar region.

Beginning on the 15th day from the onset, the sinusoidal current was applied daily, and here, I think, is the crux of the whole treatment. At first, the entire electrical application did not exceed 60 seconds. A pad electrode was placed over the lumbar plexus, and a small one was applied to the motor point of one of the affected muscles. One surge was given, of sufficient volume to cause a contraction of that muscle. Then another muscle was treated in a similar manner. For a week or more, each muscle received one contraction each day. Then, for a few days, each muscle was subjected to two or three impulses, and later five to six. By this time I possessed some voluntary muscular control, and thereafter I attempted to contract each muscle with the detection of each surging current.

I was also moving around with the aid of crutches, but could not as yet take a step

* Read at the Twelfth Annual Session, American Congress of Physical Therapy, Chicago, September 12, 1933.

without them. About the fourth week, I discontinued the hot packs, principally because they took up so much time, and because I was trying to resume regular work. But the sinusoidal current was continued and the time of treatment on each muscle increased, until the entire seance consumed about 30 minutes. Each muscle was exercised until a slight fatigue was felt.

In six weeks I could take a few steps without crutches, and after seven weeks, I discarded them entirely. Four months from the onset of the disease, I went to the Medical Officers' Training Camp at Carlisle, Pa., passed the physical examination and made every formation. On a few occasions I had to drop out of a "double time" movement, but otherwise had no trouble.

Today, five years and six months later, my legs are still queer shaped but apparently as strong as before. The only trouble I now encountered is a tendency to stumble over small elevations, such as a threshold, if I do not see them.

The point I wish to make is my belief that treatment of the paralysis of poliomyelitis

should be begun early, contrary to the usual advice of complete rest and immobilization of the affected parts for several weeks or months. It seems logical to me that the earlier treatment is begun the better.

But equally important is not to overtreat in the beginning. Exercising a muscle until it is overfatigued, is almost certain to do harm; and it is probably because of the tendency to overtreat, that the authorities have gone to the other extreme and have advised no treatment at all for the first few months.

Oliver Wendell Holmes once said that you could cure any disease if you started early enough; but in some cases you would have to start with the patient's grandfather. Obviously this is not practicable in acute anterior poliomyelitis, which doesn't happen to be of an hereditary nature. The principle is a good one.

However, the earlier proper treatment is begun, the better for the patient. In this personal report, I recognize, of course, that one case does not prove anything; but it is evidence, and it is as a piece of evidence that this case is presented.

5231 Holman Street.

HOSPITAL CLINICS

TO BE HELD AT THE CONCLUSION OF THE 13TH ANNUAL SESSION

PHILADELPHIA

FRIDAY, SEPTEMBER 14, 1934

INSTITUTION	ADDRESS	PHYSICIAN IN CHARGE	HOURS
Philadelphia General Hospital.	34th and Pine Sts.	Dr. Maurice Weisblum.	9 to 12
University of Penn. Hospital; Maloney Clinic Bldg.	36th and Spruce Sts.	Dr. Josef Nylin.	9 to 10
Episcopal Hospital.	Front St. and Lehigh Ave.	Dr. Albert Martucci.	1:30 to 5
Graduate Hospital.	19th St. and Lombard Ave.	Dr. W. T. Johnson.	2 to 4
Jefferson Hospital.	10th St. and Walnut St.	Dr. Wm. H. Schmidt.	2 to 4
Temple Univ. Hospital.	Broad and Ontario Sts.	Dr. Frank H. Krusen.	11 to 1
Jewish Hospital.	York and Tabor Roads.	Dr. Frank Follweiler.	9 to 11
Johnson Foundation for Medical Research.	University of Pennsylvania.	Dr. Detlev Bronk.	11 to 5

DIATHERMY IN MANAGEMENT OF MEDICAL KIDNEY DISEASES *

GUSTAV KOLISCHER, M.D.

CHICAGO

A discriminating medical treatment of kidney diseases becomes only possible after the patho-physiology of these disorders is clearly understood. It is now recognized that the kidneys act only as an eliminatory terminal and that their functional disorders are intimately connected with the derangement of other activities of the body. The main renal function being the elimination of certain metabolic end products, it becomes apparent that the status of the alimentary canal and its incidental disturbances must influence the renal function. The end products to be eliminated by the kidneys appear in the blood and thereby explains the importance of the cardio-vascular system for the renal function. The blood acts in two capacities; it supplies blood necessary for the function of every organ, and at the same time carries the products to be eliminated.

While the findings of the pathologic conditions localized in the kidneys are quite characteristic: capillary changes in nephritis and epithelial degeneration in nephrosis, they are always connected with definite constitutional changes. Therefore modern clinicians prefer to talk rather about nephritic and nephrotic conditions than to use the limited terms "nephritis" and "nephrosis."

Character of Affection Dictates Treatment

The specific character of the disorder will of course dictate the selection of the physiotherapeutic measures. In nephritic conditions the therapeutic indications are the release of the blockade of the glomeruli and the combating of the renal and general capillary toxicosis. In a great many instances a sufficient stimulation of the renal circulation is accomplished by medical diathermy applied to the kidneys. In some quarters objection is raised against such a therapy because it may be apt to increase the bleeding from these organs. But temporarily increased renal hemorrhage is only an expression of the release of the glomerular blockade and should be welcomed.

Renal hemorrhage will definitely stop as soon as detoxification has succeeded in neutralizing the toxins responsible for the deterioration of the renal capillaries and the production of excessive permeability or fragility of the capillary walls, the former state permitting diapedesis, the latter one hemorrhage due to rhexis of the vascular walls. The therapeutic value of diathermy is based upon attracting to the kidney by localized heat the defensive cells of the body and on the stimulation of the lymphatic and vascular circulation. The technic of applying medical diathermy to the nephritic kidney is regulated by the same general rules and restrictions that govern the administration of this modality anywhere else. In some quarters there still prevails the idea that the therapeutic effect is proportionate to the degree of heat produced, and that *a priori* one may determine the amount of voltage and amperage to be employed. Both of these concepts are erroneous. Excessive heat though not necessarily leading to immediate coagulation is apt to produce cellular necrobiosis and paralysis of the arteries, thus counteracting the factors upon which we are intending to improve. In nephritic conditions the heart is always involved to a certain extent. Moderate heating is of a beneficial influence upon the cardiac action, while excessive heating is apt to provoke low degrees of what commonly is called angina pectoris. Each diathermic apparatus is a unit of its own and so is the structural resistance of each patient. Therefore, voltage and amperage useful for one individual may be inappropriate in another. For practical use one may lay down the rule that the patient should report the sensation of warmth but not of heat. The recording of heat calls for immediate reduction of the magnitude of the current employed. It has also to be considered that an appreciable therapeutic effect may only be expected by prolonged séances of a duration from thirty minutes up to an hour.

Diathermy in Acute Nephritis

The early administration of diathermy in

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 15, 1933.

acute nephritis seems to enhance its efficiency, but there are also on record a great many instances of chronic nephritis in which systematic use of diathermy helped to provide favorable results. The employment of the aseptic protein shock is of recognized value in nephritic conditions. We prefer to use for this purpose autohemotherapy in order to avoid the disagreeable cardiac reaction associated with the administration of foreign proteins. In nephrotic conditions the topical administration of diathermy to the kidneys does not offer any rational indication. The degeneration of the tubular epithelia seems to be a secondary or corollary phenomenon. As proof for this contention may be cited the fact that the retention of the chlorides occurs mainly not in the blood but in the intermediate structures. But general diathermy as a rule, called autocondensation, seems to be a powerful aid to the dietetic measures applied in nephrotic conditions. The administration of heat to edematous areas deserves some discussion. While it may be interesting to attempt to facilitate the absorption of edema by heat, it should be remembered that an edematous cutis or the skin overlying edematous structures, is very vulnerable, and even moderate heating may produce very disagreeable nutritive dermatic disturbances.

It should be especially noted that nephrotic edemas are an osmotic phenomenon and will not disappear until the retention of chlorides within the intermediate structures is done away with by the proper dietetic and medical measures. Forced sweating of the patients is of very doubtful merit. The amount of urinary solids appearing in sweat except in the extreme stages of uremia is a negligible quantity. On the other hand the little benefit possibly accruing from forced sweating is certainly outweighed by the concomitant debilitation of the patient and the cardiac embarrassment. In nephrosclerosis diathermy, of course, cannot offer any causative therapy but general diathermy is certainly helpful in keeping the patients in relative comfort.

Discussion

Dr. Y. N. Levinson (Chicago): Dr. Kolischer's clear exposition of this new concept of the treatment of medical kidney disease by diathermy opens up an interesting possibility in therapy. It may well be that a great many internists will adopt it in the near future, because of our in-

ability to aid these patients by the more orthodox and established methods. I have had the opportunity to see some cases of medical kidney disease treated by these physical agents, heat and diathermy, and recall some good results. Along with these newer procedures, changes in our therapeutic methods have also been adopted along the line of diets. It might be well therefore, to point out the progress that has taken place in the dietary management of some of these kidney conditions.

A point to be stressed, for instance, is the more liberal attitude adopted toward protein diet in recent years. A great deal has been said and been written regarding the use of protein diet in kidney disease, and old and exploded concepts are still in active vogue, not only among our lay people but are upheld and practiced within our profession. The belief is still held that patients with nephritis or hypertension, irrespective of type, must be restricted in his protein diet. Under such a régime a great deal of harm has been done. I am a little disappointed that the essayist omitted this important phase of treatment from his discussion, because he is one who has spoken and written a great deal about this very subject.

The theory that protein elevates the blood pressure, for instance, is an old but exploded conception and dates back many years. It has been shown by Mosenthal and by Newburgh, and many others, that proteins do not elevate blood pressure, and there are some very classic observations along this line. Somewhat in the line of the spectacular were the studies of Lieb, when some years ago he placed the explorer Stefansson under very careful observation after a nine-year period in the arctic, where Stefansson practically lived on a protein diet. On his return his blood pressure was 115/55 mm. of Hg. and he showed no tendency toward any kidney involvement.

There have been other observations along this line. Thomas studied the Greenland Eskimo over a period of time, the Greenland Eskimo being known to live on a carnivorous diet almost exclusively. He found no tendency for these people to develop any form of nephritis or hypertension.

Hence we no longer take away the protein from the hypersensitive patient's diet because we do not fear its results. In fact, a great deal of harm has been done to many people by the elimination of proteins over a long period of time. They become very anemic, weak and run down, because no great benefit is obtained by the withdrawal of the protein elements from their food.

In these individuals the carbohydrate element in the food was also increased to make up the caloric value, and under this high carbohydrate diet the patient tends to become somewhat obese. He becomes more anemic, because there isn't any question that the protein in the food is very necessary in keeping up the hemoglobin and the red blood counts, and although his blood pressure perhaps does drop,

it is on the basis of general weakness and no real benefit to the patient.

In those cases where the patient is eliminating a great deal of albumin in the urine, the withdrawal of protein from these individuals becomes a protein starvation condition, because this protein when eliminated represents their actual body tissues in the course of time.

Therefore along with these changes in therapeutic methods, the addition of physical therapy methods: heat, diathermy, and so forth, we must bear in mind that there has also been a marked change in the dietary conception of kidney disease and hypertension.

Dr. J. W. Torbett (Marlin, Texas): The use of diathermy in degenerative cases and in nephrosis is a common sense application in dilating the capillaries and improving general metabolism and elimination. Kolischer's use of autohemic therapy in the toxic cases thus stopping the hemorrhage is also a practical, common sense application; also his observation that each patient's reaction to the treatment must be a very important index in all treatments.

This attitude should also be applied by Dr. Levinson in connection with the problems of high protein diet. Stefansson was put on a muscular diet of meat, and he developed a very severe diarrhea and had to stop that diet. He was then put on a meat diet, but it included all the internal organs, like the pancreas, the liver, an immense amount of fat, and only a moderate amount of the acid-forming muscular tissues, and he got along all right. That is an important observation.

I think in cases of nephrosis, the large loss of albumin must be supplemented in the diet. The acid-forming albumins like meats are not as valuable as milk and other forms of protein. When the patient gets better, the high protein diet should not be continued because damage may be done.

The patient's reaction, as Dr. Kolischer remarked, to the various types of treatment must be noted carefully, and the treatment given accordingly. The blood chemistry must be studied and especially the retention products of the urea, and the protein must not be pushed too far when the blood chemistry retention is too high. The retention of the chlorides in nephrosis is a very important proposition and the potassium chloride now in place of the sodium chloride, which should be restricted entirely, is a valuable and practical method. By using the potassium chloride and taking the sodium chloride out of the system, you are also removing the edema very rapidly, inasmuch as a gram per day put in a saltcellar could be used instead of the sodium chloride.

I especially want to call attention to the danger in just promiscuously pushing the protein without specifying what kind of protein is used, and especially without taking into consideration the

blood chemistry in pursuing this in your nephritic cases.

Dr. K. L. Puestrow (Madison, Wis.): In the management of kidney diseases the indications for the use of physiotherapeutic measures, especially diathermy, will depend upon their ability to improve function of the diseased kidney, but only as an adjunct to supplement established medical measures.

These measures for the most part have not been directed against etiologic agents, but have been symptomatic and not altogether satisfactory in improving kidney function. Disturbed kidney function manifests itself first by changes in the urine and later by those in the blood. In the decompensated kidney there may be an oliguria or complete anuria, indicating complete inability of the kidney to excrete urine, or following a polyuria of such low fixed specific gravity due to the inability of the kidney to concentrate solid waste material there may be such a decrease in total volume output that all of the waste products of the blood are not eliminated.

The effects of diathermy, therefore, may be readily appraised. If it re-establishes the volume output of the decompensated kidney with urine of low fixed specific gravity, the kidney may become compensated, while if it also enables the kidney to concentrate urine so that there is more solid waste material per unit volume with higher specific gravity it has helped to restore the kidney to normal.

It would be difficult to determine the indications for the use of physical therapeutic modalities by attempting to correlate the pathological changes which have taken place in the kidneys and the clinical manifestations of kidney disease. A small percentage of cases may be sharply demarcated into the inflammatory conditions of the true nephritics and the degenerative conditions of the true nephrotics, but many cases are blends of these two extremes both clinically and pathologically, so that there is in addition an intermediate grouping of so-called nephritics with a nephrotic tendency or a nephrosis with a superimposed nephritis. Then too, a case which may appear at one time to be a true nephrotic may develop later the picture of a true nephritic.

Only from a study of the functional response of the kidneys, therefore, can the value of any therapeutic measure be determined. This is as true of physical measures as of medical measures. Diathermy promotes increased circulation by the elevation of the temperature within the kidneys, thereby distending their capillaries. It increases diuresis of the normal kidney. In experimentally produced nephritis in animals Eppinger restored circulation whereas other diuretics failed. In acute nephritis it apparently has yielded striking results but in too few cases to draw final conclusions. It is indicated in acute glomerular nephritis especially before consideration of kidney decapsulation.

In true lipoid nephrosis there is no indication for the local use of diathermy based upon functional deficiency. In chronic nephritics the re-

sults should be dependent upon the extent of functional kidney damage. With associated arteriosclerotic cardiovascular disease anything which increases the comfort of the patient is indicated. In these cases the general use of auto-condensation may be of value. The cerebral symptoms of this disease, especially those of so-called convulsive uremia as well as the cerebral symptoms of eclampsia, have been alleviated by the local use of diathermy to the head. The extent to which physical therapeutic measures will be of value for these as well as other kidney conditions can only be determined after much more animal experimentation and clinical observation than have been made to the present time.

Dr. Gustav Kolischer (closing): I did not enter into the discussion of dietary measures because I simply wanted to confine myself to the physical therapy measures applied to medical kidney diseases.

I agree fully with the gentleman who discussed my paper that the indiscriminate starvation of the patient is just as bad as an excess in feeding. It is a matter of common sense that a patient who loses blood needs his proteins very badly, and if you starve the patient you don't do any good; you do some harm.

In so far as the nephrosis is concerned, the withdrawal of sodium chloride is one of the essentials. At the same time, if you carry that to excess, or carry it on over too long a period, these patients will suffer from achlorhydria which is just as bad as their condition. An excess in either direction is wrong.

I did not try for a minute to suggest to you or to insinuate that diathermy is a causative therapy of nephritis or nephrosis. It is simply an adjuvant. It helps along. Certain conditions may be alleviated, for instance, restoring of the circulation. In nephrosis general diathermy will help the circulation in the carrying off of the chlorides, which will never occur unless the proper dietary measures are instituted. In applying physical measures it is just as important to individualize the case and know what you are

doing as in treating any other disease. That we have to determine the condition of the patient before, during, and after the treatment is obvious.

I would like to call attention to one essential point. Whereas the examination of the urine; whereas the investigation of the blood chemistry; whereas the investigation of the digestive function are all highly important in the cardiovascular system, there isn't one single method that will tell the whole story. The evaluation of a patient, his resistance, the involvement of his organs, and what can be done, can only be recognized if we apply all the known methods in order to determine the eliminative power of the patient.

I would like to call attention to one mistake so often committed, namely, that a doctor confines himself entirely to examination of the urine in order to find albumin or find casts. In nephritis or nephrosis we may find all kinds of casts. The appearance of albumin, *per se*, is neither pathognomonic in a general way or pathognomonic to locate the lesion in the kidney, whether in the capillary system, the artery system, arterioles, or tubuli.

The same holds good in the incomplete investigation of the blood chemistry. It is highly important to recognize the fact that in so-and-so many instances the retention of the organic end products does not occur within the blood, but within the intermediate structure. The one indicator we have for finding this out without going into biologic research is to determine the content of the blood indican. If we have pronounced indican in the blood, we know we are dealing with a nephritic condition. These conditions of normal or low failures of non-protein nitrogen and high figures of the indican are the most severe cases, and quite often so severe because not recognized.

The same in diagnostic means. In any disease we apply all the known methods to improve the elimination and general condition of the patient. Certain therapeutic physical measures are very helpful.

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CHICAGO

ELECTROSURGERY IN OPHTHALMOLOGY *

MAURICE H. COTTLE, M.D.

CHICAGO

Diathermy in the treatment of detachment of the retina and various forms of pannus has given such encouraging results during the past three years that ophthalmologists generally are now seeking further experience with this newer surgical adjunct. Larson, Weve, Meller, Arnold Knapp, Gradle, and others, have lent their support in directing experimentation in this work which should eventually establish many more definite indications for electrosurgery in ophthalmic conditions.

There has been only a scant literature on this subject during the last ten years. Much of what has been written is in association with the non-surgical use of the high frequency currents in ophthalmology. The claims in this connection have been usually extravagant, so much so as to discredit the whole presentation and obscure the facts concerning the surgical possibilities.

Monbrun and M. Costeran⁽¹⁾ in a paper entitled "High Frequency in Ophthalmology," were the first who attempted to enumerate the possibilities of electrocoagulation in ophthalmology. Their discussion of surgery was limited to the lids and conjunctiva, and the attention of the reader was distracted by a wealth of detail concerning the non-surgical aspects of the high frequency currents.

Pockley and Coppleson⁽²⁾, of Australia, treated with diathermy a rodent ulcer which extended through the whole thickness of the lower lid. Healing was complete in six weeks, and excepting for a very slight ectropion extending over a few millimeters, the whole of the lower lid remained closely applied to the eye, and there was no epiphora.

Kalloch, of Armenia⁽³⁾, reported on the treatment of trachoma by surgical diathermy. This author mentions two facts which he observed and which to me are of far-reaching importance. First, he noted that intensive desiccation of a small area ($\frac{1}{4}$ inch) about the inner part of the conjunctiva extending onto the semilunar fold, followed by grattage and massage of the rest of the lids, gave the best results with the fewest recurrences. This em-

phasizes the necessity at times of combining the usual surgical measures with electrocoagulation for the best results. Secondly, he noted that in some instances in which treatment with diathermy was interrupted, or for some reason not completed, that good healing still occurred. He calls this spontaneous healing, but in my opinion it is evidence of a fact well known to those who have been using surgical diathermy for a considerable length of time — namely, that remote and late beneficial effects frequently occur.

Benedict⁽⁴⁾, in a Mayo clinic report, presents an instance of epithelioma of the limbus successfully treated with electrocoagulation.

The work of S. Larson⁽⁵⁾ as shown in his published reports beginning in 1926, was in my estimation the most original and stimulating accomplishment in this newer work. It not only brought the possibilities of electrosurgery forcefully to the attention of ophthalmologists all over the world, but also opened up a new avenue of approach to many problems which up to that time had evaded solution. This work was largely in connection with detachment of the retina and introduced the actual though limited coagulation of the sclera. As indicated above, the remote and late effects in this instance are the most beneficial, and they produce a reaction in the underlying choroid and retina sufficient to cause an adhesive process, which reattaches the retina to the choroid.

To this "surface coagulation" Weve⁽⁶⁾ in about 1931-32 added the micropuncture method. This is simply the piercing of the sclera with a very fine needle point electrode, especially in the region of the retinal tear. The punctures are usually multiple and their number, location, and depth of penetration depend on the problem at hand. Weve localizes the position of the tear by the aid of a micropuncture, and also observes the immediate effect on the retina.

Safar of the Meller Clinic in Vienna has further modified this technic, which is admirably described by Schoenberg of New York. Safar used so-called brush electrodes to reach

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inaccessible areas, and "nail" electrodes to effect a controlled partial penetration of the sclera. He penetrated the sclera in one or more places and often uses mild suction to aid in the removal of subretinal fluid.

My own technic is really a cross between that of Weve and Safar. With a fine, single needle point electrode, using a slow coagulating current, the area of detachment is circumscribed by a series of coagulated areas, not penetrating the sclera, and separated from each other by the diameter of the areas — remembering that the effect is greater and comes on later than is at first anticipated. One or two very fine holes are made in the sclera at the tear. This I do as quickly and as fine as possible, using a so-called cutting current.

Jess of Giessen⁽⁷⁾ is also an advocate of diathermy in retinal detachments. He has shown (by animal experimentation) on microscopic examination the formation of a firm union of the retina to the choroid. (He has removed the lenses of cats by introducing (after corneal section) a fine needle into the lens and coagulating its substance, thus forming an adherent mass to the electrode.)

Pannus

The electrosurgical treatment of pannus is a far-reaching advance in the management of this blinding affliction. I first used this method in 1931 on a woman of fifty who had suffered blindness in both eyes for five years due to a trachomatous pannus which persisted despite the efforts of several ophthalmologists. Her vision at present is 20/50. Another patient, operated on a little later, had a trachomatous pannus in the left eye for eleven years, with frequent occurrences of severe ulceration. This eye, following treatment, has regained much vision and has remained quiet. Other patients operated on for less severe pannus formations have regained vision to the extent of 20/20. The technic is simply a peritomy done with a coagulating current.

The conjunctiva is picked up about 2 millimeters from the limbus with a bent needle electrode about one-fourth inch at a time, and coagulated. The whole limbal periphery may be so treated at one sitting, though I think five-sixths of the circumference is usually an adequate treatment. I prefer a general anesthetic for the first operation, but I have done this several times under suitable local anesthesia. Following the operation, cold applica-

tions are applied to the eyes for twenty-four hours. An anodyne may be required during the early post-operative course.

This operation has been done by Gradle of Chicago, and, at his suggestion, by Knapp of New York and Parker of Detroit. I am informed by Dr. Gradle that, so far as he knows, satisfactory results have been obtained in most instances.

During the last two years I have used electrosurgery in the treatment of prolapse of the iris following injuries and operations.

The treatment of trichiasis with electrocoagulation has been most successful, and it is the operation of choice in the hands of numerous ophthalmologists. Monbrun⁽⁸⁾, of Paris, was one of the first to report on this.

The exenteration of the orbit for a large invading tumor is one of the most important indications for electrosurgery. In fact, many cases otherwise inoperable have been successfully managed. The repair of an orbit which is invaded by adhesions and synechiae is remarkably facilitated when electrosurgery is used.

Safar⁽⁹⁾ has reported on an ingenious treatment of blepharospasm. He locates the main branch of the facial, introducing a needle electrode into the cheek and stimulating it with a galvanic current. When the nerve is thus localized, the needle is left in place and attached to a coagulating current. This partially destroys the nerve and relieves the spasm.

I have used mild coagulation for obstinate blepharitis.

The conditions mentioned above constitute for me the major indications for electrosurgery in ophthalmology. Electrosurgery is often the method of choice, and properly carried out, is productive of good results.

There are other diseases for which surgical diathermy has been used. Among these may be mentioned canthoplasty, posterior sclerotomy, pterygium, and chalazion. I have frequently used diathermy in corneal ulcers with satisfactory results. Xanthlasma is also well handled this way. De Freagny⁽¹⁰⁾ reported this in 1931. Zubak⁽¹¹⁾ in May, 1931, reported a technic for the treatment of pterygia which he used in seven cases. Warts, moles, cysts, about the lids are, of course, easily and successfully cared for by electrocoagulation. Herbert Walker of Chicago has used surface subcoagulation about the limbus for the treatment of glaucoma.

I have refrained in general from a discussion of details of technic, as I believe at this time it is fairly well understood that only those trained in ophthalmology and familiar with the several diathermy currents should undertake any surgery with this newer method. Ophthalmologists know quite well that only good training and extensive experience can equip them to develop their surgical technic in this special field.

Electrosurgery is not advocated as a substitute for satisfactory surgical procedures, but rather as a modern advance in an attempt to solve existing problems in ophthalmic surgery. It is only by continued investigation and a wider utilization of our present knowledge that a more scientific status of the subject will eventually be submitted.

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Discussion

Dr. Samuel J. Meyer (Chicago): Dr. Cottle was one of the first men in this section of the country to apply the fundamentals of electrosurgery to ophthalmology. We must be extremely cautious not to become overly enthusiastic and attempt to cure all the ills of the eye by means of surgical diathermy.

Shortly after Prof. Weve published his article on the use of "micropuncture" in the treatment of retinal detachment, Dr. Gradle and I learned the fundamentals of the technic from Dr. Cottle and Dr. Peter Kronfeld, who had just returned from a visit to the European clinics. We have since used the "micropuncture" method exclu-

sively in the treatment of all retinal detachments which have come under our care. While our end results are still far below our hopes and expectations, the ease with which one can handle such cases by this method has proved gratifying. The labor involved is certainly less painstaking and time-consuming than the original Gonin method in which the actual cautery is used. The eyeball is also much more tolerant to this form of therapy as we now do not see any more vitreous hemorrhages, a complication seen all too frequently by the original method of Gonin.

Our success with the "micropuncture" method led us to the further use of surgical diathermy in various ophthalmological conditions. We have had very gratifying results with peritomy in the treatment of pannus due to various causes. The treatment is completely ambulatory and causes very little inconvenience to the patient. It can be repeated as often as found necessary, and to date we have had no disastrous results.

Another use of electrocoagulation which we ourselves have come to use, is in small vitreous prolapses following separation of the wound edges after cataract extraction. I have, as yet, not seen this use of electrosurgery described in the literature.

During the last few weeks we have used electrosurgery in the treatment of glaucoma, mainly cases of absolute glaucoma in elderly patients, by performing a posterior sclerotomy with the diathermy needle used in the Weve operation for retinal detachment. According to J. Strebel, who published an article in the *Klinische Monatsblätter für Augenheilkunde*, several months ago, this method decreases the intraocular pressure much better than any other procedure. The amount of hypotony not only depends upon the size of the needle used, but also upon the intensity and duration of the spark. The time elapsed to accurately determine the ultimate end results is entirely too short to report upon satisfactorily at the present writing.

As Dr. Cottle mentioned, the use of electrocoagulation in the treatment of lid tumors is very gratifying. Scar formation occurs very slowly and with very little retraction. It may also be used in hypertrophic and keloid scars, symblepharon, etc.

I firmly believe that the judicious and sensible use of electrosurgery in the various surgical affections of the anterior segment of the eye will be greatly elaborated upon within the next few years. We must proceed with the utmost caution and not let our enthusiasm overrun the basic fundamentals necessary in handling those conditions involving such an important organ as the eye.

Dr. A. R. Hollender (Chicago): I have had occasion to witness several operations on the eye performed by Dr. Cottle with electrocoagulation and must commend him on the facility with which he handles this therapeutic measure. I have been fortunate in observing the post-operative progress of some of the patients and also the end results. These speak for themselves. I am enthusiastic on the use of electrocoagulation in

pannus and it is gratifying to hear that Dr. Meyer also is so disposed.

Dr. Meyer struck the keynote of the situation when he stated that we must proceed with caution. After all electrosurgery is comparatively new in ophthalmic surgery and further experience with it is necessary before we can draw definite conclusions. The results thus far merit continued experimentation on the part of qualified ophthalmic surgeons.

Dr. M. H. Cottle (closing): In my paper I

emphasized the fact that this work should be done by qualified surgeons, and on this point all are agreed. The fact that outstanding specialists are interesting themselves in electrosurgery and are sufficiently interested to continue their trials with it is a most encouraging feature. The outlook is bright when one considers that only a small amount of work has been done so far. It is highly possible that in time the indications for electrosurgery will be extended and its usage greatly refined.

TRAUMATIC MYOSITIS, WITH HEMATOMA AND CALCIFICATION *

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Traumatic myositis is of common occurrence in many forms of athletic contests, especially, in football, basket-ball, boxing, wrestling, and other forms of sport in which personal contact plays a prominent part. In addition, the frequent contusions and injuries of everyday life often bring about the condition, which is temporarily disabling, or may be attended by more or less permanent injury.

This paper will deal with the so-called "charley horse" in athletics. The popular name is meaningless in itself, and a sort of blanket term used by athletic trainers to cover a variety of injuries which differ materially one from the other, and which should be differentiated clearly both as to diagnosis, prognosis, and treatment. For example, in the writer's experience, the following varieties of trauma are all popularly classed as "charley horse," without distinction as to pathology:

Varieties of Trauma

1. *Simple contusions* may occur in practically all forms of athletic exercise, especially in tackling and other violent personal contacts in football. The usual results attending contusions are observed, such as pain, swelling, discoloration, impaired function, rigidity, ecchymosis, and in more severe cases, hematoma. Muscular and other tissues are crushed more or less, with hemorrhage, which may be slight or severe.

2. *Muscle strain* occurs from sudden and severe contraction of a muscle, with overstretching and possible tearing of the fibers. The so-called "glass arm" of the baseball player is an example, in which the long head of the biceps is often affected; the "tennis arm," with traumatism of the pronator radii teres, is another illustration, as is also the "rider's leg," affecting the thigh adductors.

3. *Rupture of Muscle and Tendons* is a somewhat similar condition. Here also there has been great violence to a contracted muscle from sudden powerful action, with rupture of the sheath, or of the deep fascia. A herniated condition may present itself. The muscle is most frequently ruptured at the junction with its tendon, although the body itself or tendon may tear. The condition is popularly termed in athletic circles as "pulling a tendon." In some cases the tendon is torn from its attachment, detaching a portion of bone.

4. *Myositis* will be found to exist in all of the foregoing injuries. The condition may be acute or chronic. In the acute form, there is the history of recent injury (traumatic myositis). In chronic myositis, there is most generally an indication of some infectious process within the body. Exposure to cold, stretching of muscle fibers by strained and long continued postural influences, infections from colds, tonsils, teeth, etc., may commonly

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be traced as exciting causes. Chronic lower back myositis may be due to an infected prostate. These painful muscular dystrophies were formerly designated as "muscular rheumatism."

5. *Myositis ossificans*. This is a peculiar form of inflammation in which calcific deposits and plates of bony tissue develop in the substance of the muscles. It most frequently occurs as the result of continued or repeated irritation and traumatism. There is a deposit of lime salts within the tissues which may occur in masses much like a foreign body, or a general infiltration into the muscle fibers often enclosed in a capsule of connective tissue. The most common form is that which follows injury such as tearing a muscle attachment from the bone, periosteal blood clot, interstitial myositis, and the like. The most common sites are the brachialis anticus and the quadriceps extensor muscles, but the condition may also be found in other muscle groups.

6. *Periostitis*. Inflammation of the periosteum occurs frequently from deep contusions to areas not well protected by soft tissues, notably the shin—the so-called "shin splints" of athletic phraseology. Periostitis may be attended by calcific deposits, following hematoma.

7. *Hematoma*. Escape of blood within the tissues when of considerable quantity may be felt as a localized fluctuating hemorrhagic swelling, soft at first and gradually becoming hard. The size of the tumor may vary greatly. It is especially noticeable in soft, lax tissue. It is surrounded by a deposit of fibrin. Absorption may take place if the escape of blood has not been excessive; on the other hand, there may be inflammation and infection and frequently fibroid thickening and calcification.

8. *Tenosynovitis*. Inflammation of the tendon sheath may be acute or chronic. The acute form is frequently observed from injury, strains, over-use, neighboring infections, and pressure and constrictions over a tendon. This latter injury is frequently seen in skaters and ski jumpers whose tightly laced high shoes produce the condition in the Achilles tendon. The symptoms are swelling, tenderness, pain and usually fine crepitus which may be palpated, or even heard when the part is moved.

The foregoing specific forms of traumatisms

are here described, in order that the true condition of the so-called "charley horse" may be understood. Several of these conditions may coexist in athletic injuries which labor under the handicap of an inadequate and meaningless name. The frequency of their occurrence and the universal desire of players and athletic coaches to have all members of a team fit for action, or speedily restored after injury, leads us to consider the varied character of athletic injuries and the part which physical therapy may play in their treatment.

Pathologic Changes in So-called "Charley Horse"

The only minute study of the pathology and microscopic changes in muscle due to the above mentioned traumatisms, known to the writer, is that made by Drs. George Berg and T. H. Bast, of the University of Wisconsin. These investigators made their study on dogs which were anesthetized and subjected to the forms of contusions and injuries similar to those received in certain forms of athletic practice. Quotations from their findings are herewith given. Dr. Berg states that the injury commonly called "charley horse" is usually a deep contusion, very generally caused by a succession of blows. Most commonly the athlete is struck in the game of football; he limps about for a while, then continues to play, and is hit again, or on the succeeding day. A condition of stiffness and great pain occurs with some swelling and possibly superficial discoloration, the usual symptoms of contusion. There is however often a deep seated injury which is located in the deeper, rather than the superficial tissues. The reason for this is probably that the muscle substance lying close to the bone is less liable to give way to shock since it is not as freely movable as are the more superficial tissues. In dogs, a gross examination showed no change in the more superficial muscles such as the sartorius and rectus femoris, while the deep lying muscles, such as the vastus externus and intermedius were mottled in red, white and pink colors. In older and more severe cases the white mottling was predominant. Edema was marked in the deep-lying muscles in severe cases.

In the athlete there is great sensitiveness, swelling, and interference with the proper movements of the joint which the affected

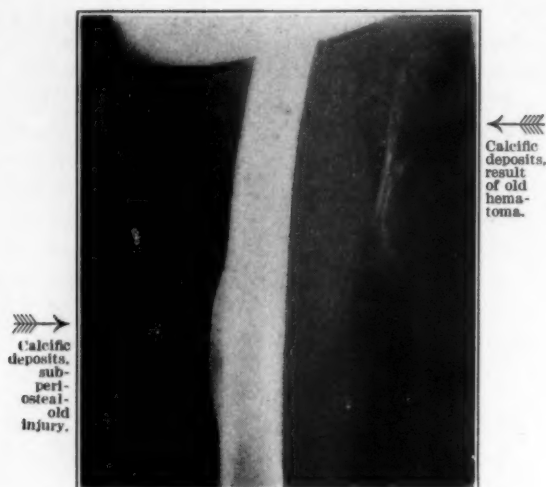


Fig. 1. Left femur, showing calcific deposits in upper biceps femoris muscle, also sub-periosteal hematoma, lower 1/3 of femur.

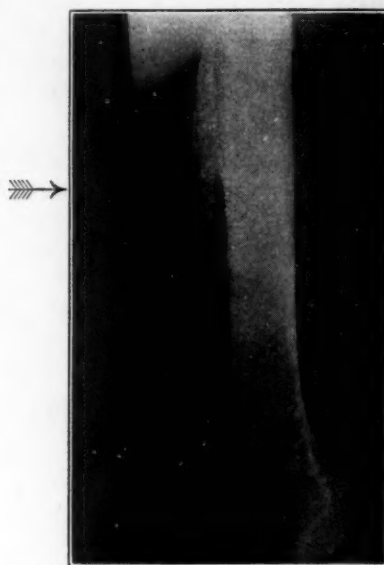


Fig. 2. Calcific deposits from traumatic myositis, with hematoma, involving periosteum, middle and upper thirds, right femur.

muscles operate. The reason lies in the extensive changes which in some cases cause complete degeneration of the muscle substance proper. This muscle tissue usually regenerates with varying degrees of completeness if it is not interfered with by additional injury. The characteristic swelling is due to the infiltration of serous fluid or plasma between the injured fibers. About the third day, if the injury is severe enough to cause degeneration, some of the fibers break up into irregular masses. Blood cells of two types, both phagocytic, appear and carry on the breaking down and excavation of the muscle substance. These wandering cells have as their function the ridding of the body of the foreign or dead material. At this time the first cells associated with the repair of muscles appear. These cells are fibroblasts, and appear in such large numbers that they produce hard knotty lumps in the muscle tissue. If the injury is not aggravated during the healing process, the chances are good that complete regeneration will take place. The entire time which may elapse, granted that there is no additional set-back, may be three weeks, or as long as five or six weeks. If the injury is repeatedly aggravated, as it often is, it is possible that permanent results of considerable damage may be remain. The seat of the injury becomes the site of mineral salts, which will leave a hard lump of calcareous and bone-like material within the muscle tissue. The illustrations which accom-

pany this article show examples of such cases. (Figs. 1 and 2.)

Prevention of the injury in athletes is of course of prime importance. Proper padding is necessary, especially for the front of the thighs, so that the shock of injury may be reduced. Padding is especially desirable even after slight contusions have initially occurred.

Treatment

The most logical form of application of physical measures seems to be heat, or alternate applications of heat and cold. Radiant heat and light, prolonged for half or three-quarters of an hour, or even longer, brings about great relief and an expedition of the healing process. Initially, rest is essential. Massage had better be omitted in the recent cases, unless it be the lightest form of effleurage. Deep and rough massage, so often misapplied by trainers, is distinctly injurious, and may cause an exaggeration of a hemorrhagic condition. In chronic cases the massage may be more vigorous, but never severe. Diathermy in the more chronic cases is of great value, and applied with a mild current long continued, greatly relieves pain and hastens the process of repair. The electrodes used should be fairly large and applied on opposite sides of the limb. It is pos-

sible that diathermy judiciously applied may prevent the formation of calcareous deposits, which so frequently occur. The decongestive effects of the static current seems a very rational form of treatment.

It is well to observe that the type of athletic injury described above is often attended by serious disability, and that the condition should never be neglected or improperly treated. Athletic trainers too often regard a "charley horse" as a trivial matter; almost invariably the injured player is allowed to continue in the game day after day; thus he is exposed to successive injuries which bring about a condition which may handicap the player more or less permanently.

Summary

The injuries received in athletic practice may be of very varied character. Rest after such injuries is usually essential, but frequently neglected. Deep bruises are practically always attended by hematoma, more or less severe. Calcific deposits are frequent results, sometimes never suspected unless x-ray examination shows their presence. Deep effects of athletic contusions are notable, often causing periostitis with calcific deposits in the neighboring structures. Physical therapy treatment is of great value, but must be administered under the care of a medical man, whose diagnosis should be accurately and promptly made.

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RADIATHERMY: AN IMPORTANT ADVANCE IN SHORT WAVE THERAPY *

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Much as diathermy has revolutionized physical therapy and become one of our most valued therapeutic agents for many affections in which the artificial production of active hyperemia by heat is indicated, it was inevitable that more effective methods should be discovered. Such a discovery we have today in short wave high frequency for which I have proposed the term — radiathermy. To appreciate the importance of this advance it is essential briefly to review the underlying factors which led to the discovery and therapeutic application of this new form of high frequency therapy.

Application of medical high frequency by means of the d'Arsonval solenoid first showed us that this type of current could be transmitted to the human organism without the use of contact electrodes. Patients placed in auto-conduction solenoids experienced heat and other concomitant benefits, without the usual electrode connections familiar to us from diathermy technic. D'Arsonval and Charrin⁽¹⁾ were even able to demonstrate that the lethal action of toxins, such as diphtheria, could be attenuated by means of a high frequency cur-

rent, produced without heating sensation. The result clearly demonstrated that the high frequency current has biophysical characteristics other than heat production and that it could be employed without actual contact with the skin.

Over forty years have elapsed since d'Arsonval called attention to what he then thought was an unpleasant heating effect of a high frequency current passed through his body, and it is about a decade since authoritative discussion first concerned itself with the biophysical problems of short radio wave currents. During this interval high frequency therapy (diathermy) has been scientifically demonstrated to possess deep heating properties superior to any other physical agent. It has been found to be a most efficient therapeutic adjuvant in subacute and chronic inflammatory conditions, because of its ability to provoke active hyperemia and to increase local and general defense.

Successful employment of the high frequency current, however, presupposes an understanding not only of its possibilities, but also of the limitations of its physical and physiologic action. It is today generally agreed

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that within the range of popularly exploited medical high frequency, i. e., between one to three million oscillations per second and between moderate and very high voltage, there is no appreciable difference in therapeutic effect. Arguments have been advanced that within this comparatively small range of frequency variable clinical effects take place. This assumption has not been verified with biophysical phenomena nor has it been supported by clinical experience. Neither has actual experience confirmed the contention that higher voltage produces deeper penetration. Differences undoubtedly exist when the oscillations exceed 10 to 100 million or more per second, but not in the wavelengths of the frequency of one or two million cycles. This polemic should be ignored because it merely beclouds some of the more important problems associated with high frequency therapy.

Effect of Short Wave Oscillations

With the advent of short wave generators by means of the radio tubes, sustained oscillations ranging up to three meter wavelengths have been utilized for biophysical experiments. Curious and unexpected physiologic and biologic effects have been produced by these electromagnetic waves, which have emphasized their deep heating properties, pointing to the usefulness of local and general fever as a protective mechanism against pathologic changes in living tissues. It has also given opportunity for comparing the effective differences between high and ultra-high frequencies, and promises, therefore, more flexible means of exploiting high frequency therapy.

Comparison of the two generators indicates that each possesses characteristics advantageous for therapeutic use. It goes without saying that diathermy is a splendid adjuvant for production of heat within the tissues. Its therapeutic advantages are too well known to need recapitulation. In comparison with the ultra short generators, however, it possesses certain disadvantages which have heretofore been accepted as minor handicaps due to physical limitations. The passage of these damp oscillating waves produces deep heating effects which according to Wildermuth⁽²⁾ show a variable penetrating power in the following manner, the unit of resistance being arbitrarily taken as 0.5 per cent of salt solution at 18 degrees Centigrade.

Resistance of Tissue to Diathermy (Wildermuth).

Fat	19.4
Brain	5.5-6.8
Lung	3.5-4.0
Liver	2.8-3.3
Skin	2.5-3.0
Muscle	1.2-1.5

Bachem⁽³⁾ more recently studied the specific resistance of human organs by submitting various tissues to high frequency, alternating, and direct currents. He demonstrated that the conductivity of various living materials varies with its heterogeneous resistance; that is, the body being composed of different resistances offers variable conduction to the passage of a current. He confirmed Wildermuth's findings of the low resistance of the skin, of the muscles, and of internal organs, at the same time proving that bony structures present the highest resistance to the high frequency current, with fat rating a low second.

The fact that resistance of tissues apparently varies with frequency, enables us to appreciate that as the frequency is increased the ohmic resistance proportionately becomes reduced. This concept has been verified by the studies of Dowse and Irédell⁽⁴⁾ and more recently by Schliephake⁽⁵⁾. Dowse and Irédell showed that as the frequency is increased the resistance is reduced. Schliephake demonstrated that with short and ultra-short radiations resistance becomes materially modified, in a manner that fat and bone, which offer the highest resistance to diathermy, become markedly good conductors.

The ready penetration of ultra high frequency current has provided a new approach to the production of controllable systemic fever and promises to replace other methods for treatment by hyperpyrexia. Its favorable effect in general paralysis has been noted by many competent observers. It remains only to prevent arcing effects in the presence of supersaturated moisture to make it a safe procedure in many instances now considered speculative. Its greatest promise lies in the field of topical treatment wherein its frequencies may overcome inherent resistance of tissues and other handicaps. By employment of rubber insulated electrodes one can apply this current over the clothing of the body, through the dry hairy portions of the male chest, through the scalp, and even through plaster casts.

Theoretical considerations of the ability of short wave diathermy to pass through fat and bone, by electrodes placed over clothing or other insulated material interested me to study the clinical effects of short wave radiation for which I utilized an apparatus by the H. G. Fischer Company. This new short wave diathermy was developed to enable the use of low voltage capacity electrodes as a simplification of therapeutic technic. Low voltage capacity electrodes demand higher frequencies than conduction electrodes. Frequencies upward of ten million cycles per second are suitable for this purpose. The instrument in question supplies a current of 12,700,000 cycles per second, and transforms 60 cycles power into 12.7 megacycles by means of (1) power transformation and series control impedance, (2) a rectification system, (3) high frequency power oscillation.

Experimental and Clinical Observations

That we have not been working in unexplored fields is indicated by the growing literature on the subject. Independent but parallel studies have been carried out in various countries, each investigator using short wave generators of different or like wave meter. We have today considerable evidence on the action of a range of ultra-high frequency of 10 to 100 million cycles per second.

With 30 meter wavelengths (10 megacycles) Carpenter⁽⁶⁾ aborted the chancre stage of syphilitic infection in inoculated rabbits, calling attention at the same time to the parallel reduction in the Wassermann and Kahn reactions in the animals. Studying the *in vitro* influence on bacterial growth in short wave fields, Haase and Schliephake⁽⁷⁾ observed a quicker lethal action on staphylococci and tuberculous organisms subjected to ultra-short wave as compared with controls in water baths at the same temperatures. Schliephake has rendered an outstanding service by compiling and analyzing the contributions of the experimental work accomplished in biologic and physiologic fields related to our medical problems. His recent book on short wave therapy is a valuable reference regarding the nature of short wave action on biologic processes.

The body being composed of various electrolytes, studies of the action of short wave frequencies on the component elements of physiologic solutions of salts, acids, and bases, have demonstrated that for every separate frequency there exists a dilution which thermally

reacts more than others. According to Patzold⁽⁸⁾ one can determine the specific wavelength by bringing the solution in a short wave condenser field. The frequencies which raise the temperature to the highest level in the shortest time are most selective. Theoretically, the tissues of the body forming heterogeneous electrolytic media may respond to particular wavelengths. This is a speculation as yet unverified. It furthermore involves insuperable difficulties in the scientific selection of an optimal frequency for all organs. However, short waves appear to influence the smallest particles of matter, because the electrical condensers act directly on the molecules and colloid particles in the body and transform the energy impulses into heat.

The prompt physiologic action and intense deep heating effect are more correctly explained by analogy than by actual observation. Esau's⁽⁸⁾ observations are perhaps the fulcrum to the biophysical reactions within the tissues. Alkalinized water when shaken with paraffin oil and placed in a condenser field begins to boil with escape of steam. In spite of this the liquid attains only a temperature of 60 or 70 degrees Centigrade. Yet, as pointed out by Schliephake, the tiny drops of water in the solution must have been heated up to 100 degrees Centigrade or they could not have been converted into steam. The paraffin oil in spite of its intimate mixture was only slightly heated and the droplets of water are interpreted as selective for the action of the condenser field. The corollary to this reasoning is that exquisite physiologic effects may be obtained with ultra-short wave diathermy by means of heat intensities lower than customarily required by other heating agents and reactions that follow the formula of van't Hoff.

The wavelength for maximum heating power is still an unsettled problem. Schliephake and Patzold advocate a range from 3-15 meters. The wavelength employed by Carpenter and other American workers is about 30 meters. The one used by me was considerably higher than those employed by our German colleagues, but may with greater experience be modified. Although clinically effective my experience with this form of radiathermy is too limited to warrant authoritative assertions.

Superiority of Short Wave

Using a 23.6 meter wavelength and electrodes insulated on both sides with rubber covering, experiments were undertaken to in-

crease our knowledge of short wave diathermy. The electrodes acting as condenser fields were placed upon the covered body to produce sedative deep heat sensation. They were of both equal and unequal size and attached to the body or limbs by broad elastic bandages. When either condenser electrode was held several centimeters from the body, the one in closer contact with the body attained a greater heating effect. Treatment properly administered produced pleasant sedative sensations. The thermal sensation was no greater than that experienced with a pleasantly warm water bag. Intensification of the current promptly produced sensations of unbearable heat. The technic of electrode application was simplified as compared with that utilized in diathermy. With this method of creating artificial heat both the field and technic of application offer facilities unknown with diathermy. One needs only to recall that hair, clothing, plaster casts, and the like present no obstacle, to appreciate the ease with which the brain, the chest, the prostate, orifices, irregular external contours of the body, to cite a few examples, can be subjected to the influence of short wave radiation by the simplest imaginable technic. To this we add that we have observed no untoward reactions while the therapeutic results have been enhanced.

Clinically gratifying recoveries have been observed in pyogenic infections, such as carbuncles, furuncles, and certain varieties of arthritis. This list is by no means exhausted. The very possibility of utilizing this form of treatment in pyogenic infections at once opens a new field for radiathermy. Whereas diathermy has been found to be contraindicated in pus infection, Schliephake⁽⁹⁾ has demonstrated radiathermy to be valuable in all forms of infection. He states:

"The treatment of furuncles proves an especially favorable field for ultra-short wave therapy. Up to the present time I have treated about three hundred cases, part of them very marked, and in only one instance was I forced to resort to surgery. In all the other patients operation was avoided. It was the same with abscesses of the axillary sweat glands, which are always very obstinate, and with large carbuncles. When such a furuncle is treated usually the pain and the unpleasant feeling of tension disappear very quickly. Around the furuncle appears a reddened area. After from twelve to twenty hours a sharp demarcation takes place and the furuncle acquires a dull brown color. With daily treatments the course is reversed and after a time the con-

dition returns to that preceding treatment. Recent furuncles dry up and are absorbed. In older furuncles which are already softened there soon occurs, frequently during the first treatment, an evacuation of pus, and healing takes place with unusual rapidity. In the furuncles I have thus far treated healing has taken place in an average of four and a half days. Naturally, in case of large carbuncles the progress is not so rapid; nevertheless, I have seen carbuncles the size of a hand disappear in two to three weeks."

Equally good results are reported in empyema of the antrum and ethmoid bones. The disagreeable odor disappears in from 6 to 10 days with gradual lessening of secretion.

Conclusions

Radiathermy represents a decided advance in high frequency therapy. It offers many advantages over ordinary diathermy, and is characterized by a greater range of flexibility and more profound physiologic action. It establishes new indications for use because of its profound heat action, deeper penetration through all tissues including fat and bone. Short wave diathermy has particularly demonstrated its therapeutic value in pyogenic infections and its ability to enhance the defensive mechanism of the body.

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A NEW TYPE OF ELECTRODE FOR DIATHERMY AND ELECTROCARDIOGRAPHY *

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Because of certain objectionable features still inherent in block tin electrodes employed in diathermy, I wish to offer a new type of electrode for use in diathermy and in electrocardiography. This new type of electrode was made possible by the application of a previous invention of my co-worker, Mr. Samuel Ruben. Several years ago Mr. Ruben, in a series of interesting experiments, was successful in converting ordinary cellophane from an insulating material into one having high electrical conductivity. This conductive cellophane forms one of the basic parts of the new electrode which is composed, briefly, as follows:

A sheet of tin foil is cemented to a sheet of conductive cellophane. This is then coated with a special adhesive paste. The adhesive surface of the electrode is then sealed by means of a protective film, which permits the electrode to be kept indefinitely in perfect condition. When the electrode is ready to be used, the protective film can be instantly removed by simply moistening it and stripping it off, thus exposing the adhesive surface of the electrode for direct application to the patient's skin.

Advantages

A few of the advantages which we have observed in the clinical use of this type of electrode may be summed up as follows:

1. It is light as a feather, being about 2/1000 of an inch thick. This makes it particularly satisfactory for applying over tender areas, or in treating pneumonias and like conditions.

2. It is tough, and has ample tensile strength to meet practical requirements.

3. It has high electrical conductivity, and the current is distributed evenly throughout the electrode.

4. It is adhesive, eliminating the use of bandages, bags or adhesive tape to hold the electrode in place. This adhesive mixture is

electrically conductive and extremely tacky and ductile, so that, even if a wrinkle or ridge should appear in the electrode, the stringiness of the adhesive will conduct the current without sparking. This adhesive is non-irritating; it is water-soluble and can be easily removed from the patient's skin by simply wiping it off with a moist towel. Aside from the convenience of application, however, the main purpose of the adhesive is to afford intimate contact of the electrode with the skin.

5. The electrode is plastic and can be instantly moulded to any part of the body, no matter how irregular the surface.

6. It forms perfect contact on account of its plasticity and adhesiveness. Consequently, there are no "hot points"; there is no sparking.

7. It is perfectly comfortable for the patient; in fact, the patient is hardly aware that the electrode is in place, and experiences only a pleasant sense of warmth, even when comparatively high amperage is used.

8. It is convenient to use. The electrode is made in strips 3 inches wide and 10 yards long, and is wound on spools, very much like ordinary adhesive tape. Like adhesive tape it can be applied with no loss of time, with no waste, and in any manner desirable. Unlike adhesive tape, however, it can be removed from the patient's skin without discomfort.

9. It is sanitary. There is a new electrode for each patient. This advantage needs no elaboration.

In regard to the leads connecting the electrical apparatus to the electrode, we have discarded the usual heavy, rubber-insulated wires, and are using in their place an extremely light aluminum or copper ribbon about one-half inch wide, insulated with a special preparation applied like a thin varnish. This type of lead should be used with this electrode. The ribbon is connected to the electrical apparatus by means of a small clip, and the other end is attached to the electrode with a small piece of adhesive tape or of the electrode itself.

* Read before the New York Physical Therapy Society, New York, Feb. 7, 1934.

This electrode can be applied with ease to any part of the body. It can be applied along the course of a nerve, around an ulcer, over the vertebral column or any other irregular surface. When a large electrode is required, several strips should be applied, each strip slightly overlapping the one next to it. In cases of endo-thermic surgery the anesthetized patient may be moved to any position desired by the surgeon without fear of disturbing the electrode, thus minimizing the chance of severe burns.

In electrocardiography a modified electrode is to be used, which offers a higher resistance, gauged to meet the requirements of the type of cardiograph employed.

For the treatment of fractures the electrode to be used is coated with an adhesive which will hold it in place for several weeks, if necessary. It will be possible to apply this electrode just before applying the plaster cast, attaching the copper ribbons so that they will protrude from the cast. Diathermy treat-

ments may then be given at any stage of the convalescence without in any way disturbing the fracture, or the patient. In the electrode to be used for this purpose aluminum foil is substituted for the tin foil, thus permitting the transmission of x-rays. In regard to the induction of fever with diathermy no experiment work has been done with these electrodes, but considering their high conductivity, plasticity and perfect contact, they should lend themselves admirably to this purpose.

Conclusion

I have found that, considering the various conductive tissues used here and abroad in combination with electrode jellies, metal plates or mesh, bandages, etc., this new electrode, which combines the various desirable features plus an adhesive effect, has proved very satisfactory in the limited clinical material upon which I have been able to study its action.

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PHYSICAL THERAPY IN FRACTURES *

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The treatment of fractures has improved considerably since the war, but in general it is still the most poorly handled field of surgery. The majority of fractures are, and probably always will be, treated by the general practitioner. Their great difficulty is in appreciating which ones they can properly attend and which need to be cared for by someone with special experience. Irretrievable damage in some cases is done by lack of expert care in the first few days. The toll of permanent disability following fracture is far too great, and will be diminished only by constant effort to educate the entire medical profession. No method of treatment can return to normal an improperly reduced fracture.

In order to know what assistance the fracture surgeon may expect from physical therapy, it is necessary briefly to review the pathology of fracture. When a bone is broken,

blood and tissue juices pour out from the fractured ends and from the adjacent injured tissues. Clotting takes place almost immediately and repair commences. New connective tissue cells appear and start to grow into the clot from each end of bone to be replaced later by the deposit of bone salts, producing first callus and later bone. Even when solid union has occurred, change still goes on in the arrangement of the bone cells to take up stress and strain and to assume the character of normal bone structure. While the process of new bone formation to replace blood clot goes on, waste products must be removed. Many cells are killed or severely injured at the time of fracture and the circulation must remove this debris. Local calcium is set loose from the damaged cells and it must play its part in the formation of new bone or be absorbed into the blood stream. Nature always overdoes a repair job and many cells and much fluid are brought to the part

* Read before the Eastern Section of the American Congress of Physical Therapy, and the New York Physical Therapy Society, New York, April 7, 1934.

which are of no use. They must be dissipated.

This is the simple situation, with an immediate successful reduction followed by effective immobilization. More commonly the injured part is immobilized in an indifferent fashion. While the patient is being moved to the place of treatment the fractured ends can churn about within the muscle and do further damage. Blood clot which has formed immediately is broken up and fresh extravasation occurs. Too often reduction is delayed for hours or days and connective tissue which has commenced to form is then broken up. Nature has to begin the repair process over again. One still finds men who believe a fracture should not be reduced until the swelling has gone down. The quickest method of reducing the swelling is to reduce the fracture. Insufficient immobilization after reduction hinders Nature's repair work, since the slightest movement at the fracture site will tear or displace newly formed connective tissue cells.

In immobilizing a fracture future function must be given as much consideration as present anatomical position of fragments. Where muscle pull in one direction is more powerful than in another, generally the stronger not the weaker muscles should be put on a stretch, e.g., splints should not be applied allowing foot-drop. It will take much longer to return to normal a shortened tendo-achillis than shortened muscles on the anterior surface of the ankle. The duration of immobilization can be longer in a shaft fracture than in one involving a joint, first, because union takes longer in the former and second, because the greater the distance from a joint the less probability there is of stiffness following fracture. At present I believe that physical therapy is used more to correct the results of bad surgery — indifferent reduction, improper or insufficient immobilization, fibrous replacement of edema — than for prophylaxis or early treatment, where it is chiefly of service.

On the basis of the pathology of injury and the physiology of repair, what assistance does the surgeon anticipate from physical therapy?

1. To hasten the laying down of new tissue. The processes of repair outlined above proceed through the local blood and lymph supply, brought about by the general circulatory system. Part of this supply has been

damaged by the injury. The remainder must be assisted to carry an extra burden.

2. To carry away waste matter. An injury means that some cells are destroyed. Dead tissue must be carried away. Increased demand on the circulation is made to accomplish this.

3. To increase local heat. There is reason to believe that within certain limits increased heat aids the processes of repair in ways other than mere dilatation of vessels, possibly by some effect on the temperature of the chemical process.

4. To prevent stagnation in the parts. Edema, if present, must be removed as rapidly as possible.

5. To relieve pain. Often more is accomplished by physical treatment than by sedatives.

6. To maintain muscle function. Not only is this worth while for its own sake, but also active use of muscle is one of the chief means of obtaining adequate blood supply to an extremity.

7. To maintain joint function. If early motion at the joints on either side of a fracture can be obtained without endangering the proper healing of a fracture, the length of disability is diminished.

8. To maintain the patient's morale — to have the patient feel that something is being done for him and to secure his cooperation in the doing of it.

The surgeon must accept entire responsibility for treatment of a fracture under his care. He must decide on the necessity for and time of reduction, the type of immobilization, the correctness of the reduction, (he should not accept the report of the roentgenologist without personally seeing the x-ray films), the time at which motion of joints shall be started, the time of removal of splints, the time for weight-bearing. The physical therapist should not take the initiative in any of these matters and he should not allow the surgeon to throw any of these responsibilities upon him. At the same time the surgeon should welcome suggestions from the physical therapist as to modalities which the latter thinks might be of value in an individual patient. But the physical therapist should insist that the surgeon give the order for their use. By placing the entire responsibility on one person there can be no question about the legal and moral obligation.

We should consider how a surgeon views the value of the various modalities of physical therapy to attain the eight aims mentioned above.

1. *Position of the injured part.* In one of the most recent books on physical therapy there is no mention of this in the section on fractures. Elevation of a fractured extremity after injury and until all swelling has disappeared, is of more importance than heat or massage. Gravity will do much to prevent and relieve edema. A patient lying in bed with an injured lower extremity does not need a pillow under the leg, but some arrangement by which the site of injury is kept at a level above the heart. A fractured wrist should not rest in a sling all day, but a considerable time should be spent standing with the elbow resting on a mantel piece or sitting with the arm on the back of a chair. This assists venous and lymph return flow and relieves stagnation.

2. *Heat.* In superficial injuries cold should be used for the first twenty-four hours to prevent further extravasation. In the majority of fractures I think this is a theoretical consideration only, so that heat should be applied as soon as possible. With reduction, immobilization, and elevation, increased extravasation is usually not evident. Frequently the application of heat consists in the use of a thermolite ten to fifteen minutes, once or twice a day. In this way it is merely an aid to massage. The part should be kept somewhat above body temperature through the whole twenty-four hours by means of a thermolite at a proper distance, a covered cradle with electric lights beneath, or some similar means. Infrared is a good form of heat, but again is used only as a form of, or an aid to massage, if it is employed once or twice a day. Heat improves the circulation, relaxes the muscles, and carries away extravasation and detritus.

Absurd treatment has a good example in a case I came across recently. For several weeks heat had been applied daily to a circular plaster casing and the doctor expected to be paid for it. Evidently the medical profession needs considerable instruction in physical therapy before being capable of utilizing its various methods and agencies.

3. *Massage.* Massage should be used early, when there is pain, and edema and extravasation of blood are present. Late, it is

probably of little value, if early treatment has been carried out properly. Superficial sedative massage is the only type which should be used. Any form of massage which causes pain or apprehension on the part of the patient, is contraindicated in acute injury. Superficial massage is excellent before reduction, as long as its use does not delay the time of reduction. After reduction it should be started on the day of injury, if the part is exposed. If in a cast, massage should be commenced as soon as it can be safely removed. One great advantage of molded plaster splints, over circular plaster bandages, is that they are removable for treatment by heat and massage. Treatment in traction-suspension also allows complete exposure of the part. If possible, superficial massage should be employed more than once a day. It is sedative, increases circulation, and dissipates waste products and edema. Deep massage should not be used until solid union is present, as blood clots may be loosened, embolism started, healing interfered with, and the fragments displaced.

4. *Muscle stimulation.* This may be obtained by various types of the faradic current. If steady and minimal stimulation is used, it preserves muscle tone and improves the circulation. It can be used to some extent with a part in a cast. I was impressed by the possibilities of the Morton-Smart machine as demonstrated at Dr. Sherman's clinic in Pittsburgh, although I have had no personal experience with it. Originally it was too expensive for general adoption, but I understand simpler forms are now available at much less cost. Such treatment should be in the hands of well trained persons. It must be absolutely painless and non-spasmodic.

5. *Active motion.* If active motion of the joints involved in the fracture, or either side of the fracture, can be carried out without disturbing the position of the fragments, it is the most important physical method of treatment. Union is the first consideration, but return of function is a close second. By active motion I mean that which is accomplished entirely by the muscular efforts of the patient's own injured extremity. It should not cause pain. Pain is the natural warning that continuation of such movement may produce damage. When so instructed, the patient can usually be trusted to use no range of motion beyond that where pain commences. The pa-

tient does not resist physical motion which he makes himself. Let someone else lay a hand on the part and his protective mechanism immediately becomes evident with resistance of all the regional muscles. Motion now becomes neither active nor passive, but resistive. It is an exceptional person who can relax completely for passive motion, and even such a person can almost never do so in the presence of acute injury. Although the technician does not touch the part, his function in guiding active motion is all important. Treatment by open operation with internal fixation often allows earlier active motion. Many forms of skin or skeletal traction permit immediate active motion without danger. Treatment in cases with molded plaster splints in some locations makes possible early active motion by the removal of the bandage, or of one of the two splints while manually controlling the fracture site. This treatment should be given solely by the surgeon who reduced the fracture. Many Colles' fractures without much comminution can be treated by the third or fourth day.

In general there is no excuse for immobilizing any joints except those on either side of the fracture. Yet it is common to see splints applied to the finger tips for a Colles' fracture. They should never extend distally beyond a line where complete function at the metacarpophalangeal joints is possible. Frequent active motion of all the fingers and the individual joints should be insisted on. This means contraction of the major portion of the muscular bulk of the forearm, which increases the circulation of the forearm and through it the site of the fracture. It also helps to dissipate edema in the fingers, prevents the later fibrosis about finger joints, and preserves the precision movements.

With a hand, wrist or forearm fracture, the patient should not be allowed to keep the arm quietly in a sling. He should be trained to exercise the shoulder in all directions several times a day with particular emphasis on abduction and external and internal rotation. I have seen disability at the shoulder joint, when we felt certain that there had been no original injury there, last longer after a Colles' fracture than the disability at the wrist joint.

In bed, patients with fractures of the lower extremities it is important to give instruction in exercises for the three uninjured extremi-

ties and the back. This helps the general circulation and the patient's morale. Also when he is allowed up his entire weight will be borne on one leg and on his arms through crutches. His progress will be more rapid if these muscles have previously been given attention. For the same reasons in fractures of the spine, active exercise of all four extremities should be practiced.

Active motion so far as possible should be commenced on the day of injury. Each day that joints are held immobile is apt to increase the time before return to normal function. There is nothing that serves so effectively to dissipate edema as guided motion. In addition to the physical improvement brought about by obtaining the patient's cooperation in active motion, the psychic effect plays a real part in promoting early function. Many patients, once having been trained, show a great interest in demonstrating throughout the day how much they can do for themselves.

6. *Passive motion.* Passive motion has no place in fracture treatment, at least until solid union has taken place. As stated above, passive motion on such a patient is really resistive motion. I do not care how perfectly trained or adept a masseur may be, he should not be given nor should he accept the responsibility of moving the joints either side of a fracture until union is absolutely solid. This holds true whether the surgeon administers his own treatment or turns it over to a physical therapist or technician. Fragments may be moved, processes or repair may be interfered with, pain may be caused, and muscles may be overstretched causing spasm. It is preferable that the joints adjacent to a fracture should never be moved until the bone is solid, than to have any passive motion employed. In addition to consideration of the welfare of the patient, one must also appreciate the frequency of malpractice suits in fracture cases and not lay one self open to the possibility of increasing the damage done by the original trauma, and thereby incur legal liability.

After union has taken place, passive motion should not be necessary, if proper treatment has been given during the earlier stage. Unfortunately, under present day treatment it is needed all too often to break up adhesions due to the fact that edema has not been dissipated early, to stretch muscles which have

been allowed to contract in poor balance, and to mobilize joints which have become fixed by lack of use or by edema. But remember that you are not treating the results of injury but the unfortunate results of treatment or lack of treatment. Here again cooperation of the patient is most important. Firmness with gentleness is necessary. Forced stretching does more harm than good, both physically and mentally. Muscles and ligaments are sometimes torn by forced stretching, accompanied by prolonged pain, spasm of muscles and even ecchymoses. If a patient comes for treatment with a feeling of fear, something has been wrong with previous treatment.

7. *Diathermy.* Diathermy is used in fractures to increase heat in the deep parts. By increasing the circulation it is expected that waste products would be carried away more rapidly and more bone salts brought to the part. As a matter of fact, we have no evidence that the amount of calcium or phosphorus in the diet or the blood has the slightest effect on the rate of healing of a fracture. Probably the bone salts used in repair are obtained locally from the bone which degenerates at each end of the fracture as a result of injury. To increase the local deep heat is just as liable to mean that bone salts are carried away more rapidly from the site of injury as that more calcium and phosphorus are deposited there. I watched the effect of diathermy for a period of about two years. In some cases I thought healing was hastened. In others, although the x-ray showed callus formation progressing normally before diathermy was commenced, I saw in the x-ray definite absorption of callus and clinical union become less firm while diathermy was being used. I believe it is impossible to forecast what effect it will have on an individual patient, and, I have therefore discarded its use for the past eight years.

8. *Hydrotherapy.* Many forms of hydrotherapy are useful in the late treatment of injury. Hot baths, the Scotch douche, and particularly the whirlpool bath are valuable in late edema, and to restore muscle, tendon, and joint function.

9. *Exercise.* Reeducation of muscles and joints by means of gymnastic apparatus and occupational therapy is valuable in late treat-

ment. Wherever obtainable the latter is much more important since the exercise becomes automatic and rhythmical. The possibilities in this field are not sufficiently appreciated. Such therapy can never be standardized, but requires ingenuity on the part of the operator and personal interest and instruction in individual cases.

So much for what a surgeon thinks of different physical methods. A warning must be given about prolonged treatment by physical therapy, particularly in patients coming under the compensation laws. Each treatment makes the patient feel better. As long as he is under treatment he does not have to return to work. In our interest in improving his local condition we are likely to fail to see that the gravity of his injury is increasing in his own mind. Many patients when told that they are ready for discharge will insist on further treatment. A neurosis has developed under our eyes which may take longer to cure than the original injury.

The physical therapist should insist that all patients be seen by the surgeon at least once a week for discussion of the progress, change in indications, and time when the maximum improvement has been reached. Nothing is more inimical to the progress of physical therapy than to have patients remain under treatment for too long a period. A man who has broken his leg and recovered to the point where he walks on it a mile a day, does not need to come to a clinic for heat and massage. Often a man is receiving treatment by physical methods when what he really needs is a neurologist. We should remember that these methods do not cure a person, but help him to cure himself.

Physical therapy has no place in the treatment of fractures in children. It is unnecessary, because the function of muscles and joints will return completely and promptly by the child's own active motion when all splints have been removed. Moreover it is inadvisable because rarely can the child's cooperation be obtained. Without cooperation such treatment had better not be given.

Conclusion

Physical therapy can be an important adjunct in the treatment of fractures. No after treatment can make up for late or poor reduction, ineffective immobiliza-

(Concluded on page 497)

THE GASTROINTESTINAL TRACT IN CHRONIC RHEUMATISM *

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It is my impression that rheumatism is a systemic disease⁽¹⁾ and includes the syndrome of nerve, muscle and joint affection called neuritis, myositis, fascitis and arthritis according to the locomotor or skeletal parts affected. No part of the anatomy is immune to the effects of the virus which we assume is the direct cause of this disease. The anatomy and physiology of the gastrointestinal tract are involved in the etiology of rheumatism and undoubtedly undergo alteration as a result of the disease.

There has been so much discussion by the profession and the lay public over the relation of teeth and tonsils as foci of infection that I shall limit my remarks to this phase of the problem to the following opinion: We must not forget that in removing the permanent teeth we are seriously handicapping the individual's preparation of food. Extracting live teeth can only be harmful. Extraction of infected teeth during activity of the joint disease may induce a more violent course.

Gastric Secretion and Rheumatism

It becomes obvious at the very outset that for a better understanding of this problem a discussion of the physiology of the stomach as related to rheumatism is essential. A high percentage of my patients with chronic arthritis show signs of achlorhydria on repeated tests. Several factors are at once obvious to explain this deficiency. Most of the sufferers from chronic arthritis have passed their fortieth year. Achlorhydria is common to a high percentage of all people in and after middle life. Hydrochloric acid is especially likely to be absent in women. Anemic women past middle life comprise the largest group of victims of chronic joint disease (over 81 per cent in the present series). Achlorhydria may on the other hand simply accompany the emaciation shown by many of the patients with atrophic arthritis. Very marked examples of atrophic arthritis are found in people with the Stiller or ptotic habitus. Achlorhydria is frequent in these asthenic types. A certain

allergic element has been repeatedly demonstrated in both acute and chronic arthritis. Alkalosis is known to intensify and protract the maximum allergic states⁽²⁾. Increasing the body's hydrogen ion concentration by administration of nitrohydrochloric acid has effectively controlled some of the most severe allergic manifestations, such as hay fever.

On finding an absence of free hydrochloric acid in my routine Ewald tests I give dilute hydrochloric acid, one to two teaspoons at each meal. The acid is aimed to aid in the digestion of cellulose and of the connective tissue in meat. This improved digestion will make conditions less favorable for the bacteria in the colon by removing the cellulose, their important food. The fermentation of this otherwise indigestible carbohydrate is thereby restricted, obviating the belching, distension and even the fermentative colitis often complicating chronic arthritis. The entrance of acid into the duodenum is necessary to the secretion of secretin, the normal stimulant to the outpouring of the ferments by the pancreas and the small intestine. Free acid is the primary defense of the upper gastrointestinal tract against the invasion of bacteria. The acid also tends to raise the hydrogen ion concentration of the body and is thus conducive to control of the arthritic's allergic element. That the tendency of acid state is advantageous to the mobilization of calcium is borne out by recent reports of improvement by calcium injections. Calcium has found favor with many of us in the treatment of the arthritides. It reduces capillary permeability and thus limits exudation. Calcium is also an important aid in controlling allergic manifestations.

Influence of Bacteria

Most present-day investigators agree on the infectious origin of the arthritic syndrome. From the teeth to the anus the gastrointestinal tract is a great bacterial incubator. In this incubator, teeming millions of organisms are struggling with and against each other for existence. Some of these bacteria perform a

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distinct service. For example, the colon bacillus group, by virtue of its luxuriant growth and powerful toxins, is considered a protection against invading pathogenic strains.

With few exceptions most bacteriologists have given most consideration to the streptococcus as the cause of nonspecific infectious arthritis. In a recent publication⁽³⁾ I reported isolating streptococci from the blood in chronic arthritis from about 70 per cent of patients cultured. These blood stream bacteria were enterococci having all the characters of organisms accustomed to an intestinal environment. As regards the gastrointestinal tract, the causal organisms are commonly considered as localized to infections of the gall bladder or appendix. Undoubtedly these structures are frequently invaded by streptococci. Thus they may serve as foci of infection. As a matter of fact the gallbladder and appendix are only exceptionally removed with any improvement in the rheumatic state. On the other hand the colonic mucosa offers square yards of an absorptive surface favorable to the growth of myriads of pathogenic organisms. In his recent experiments with *B. prodigiosus*, Arnold⁽⁴⁾ has shown that bacteria can enter the blood from the bowel. Herrold and I reported, in 1929, that streptococci were unusually numerous on the colonic mucosa of arthritics⁽⁵⁾. In this method of culture a sterile finger cot is drawn over the index finger. Sterile vaseline is applied. The end of the finger cot is rubbed against the rectal wall and the bacteria so secured are transferred to fresh blood agar plates. The bacteria are streaked out. A colony count is made after incubating 24 hours. Against the bowel wall the pathogens are favored by heat and moisture and are protected from the bacteriostatic agencies in the bowel lumen. It is probably that these streptococci are true parasites rather than excreta of the colonic wall.

Repeated cultures of the rectal wall have usually shown an extremely constant relation between the various colonic strains. The proportion of streptococci to colon bacilli varied to some extent with fluctuations in the arthritis, or with the frequency of evacuation. Occasionally we found white staphylococci. It will be recalled that Crowe attaches great importance to the staphylococcus group in the causation of chronic arthritis. In most instances the streptococci were greening. Their

colonies were "smooth." For the most part these bacteria grew in bile, were resistant to heat, and fermented sugars, to justify their classification as enterococci, i. e., a form of streptococcus occurring frequently but sparsely in the bowel under normal conditions. Only exceptionally were hemolytic streptococci isolated. Neither the kind nor the percentage of the various streptococci bore any relation to the severity of the arthritis. Uninfected controls showed only an occasional streptococcus colony. Streptococci were abundant in the rectum of one patient with rheumatic purpura. This patient later developed chronic arthritis in her cervical vertebrae.

The frequency of the streptococci varied from a few scattered colonies to ninety per cent of the growth on the plate. The cocci may displace the colon bacilli as the predominant bacteria. Two patients with ulcerative colitis unassociated with arthritis showed streptococci in abundance. Streicher and Kaplan have especially emphasized the streptococcal flora in this disease. The frequency with which arthritis complicates ulcerative colitis must be recalled. Patients with osteoarthritis showed only the occasional streptococcus colony recognized as a normal finding. Cultures from 12 other nonarthritic individuals showed no streptococci.

Repeated cultures showed the remarkable constancy of the kinds and quantitative relations of the various organisms. Three patients with chronic infectious arthritis had no streptococci in the bowel. One of these had chronic prostatitis.

Reduction in the number of rectal streptococci usually paralleled any improvement in the joint condition. Colon bacilli have been more or less abundant depending upon the luxuriance of the streptococcal growth. In ten per cent of the cases, hemolytic colon bacilli accompanied the usual *B. coli communis*.

The green streptococci isolated from the rectum are relatively avirulent. They do not kill mice when injected intraperitoneally. They do not harm rabbits on intravenous injection. Possibly this lack of pathogenicity can be attributed to the fact that the animal tissues have not been sensitized to the streptococcus protein. If the streptococci were capable of producing arthritis from their location in the human colon the best evidence of their relation to arthritis would be the production of arthritis in an animal on implantation in

its colon. In fact, I succeeded in producing arthritis by introducing a culture of the freshly isolated human strains into the rabbit's colon. The rabbit's colon was previously injured by swabbing with 25 per cent to 50 per cent phenol. The organisms were recovered from the involved joints.

Weak dilutions of hemolytic streptococci were rapidly fatal to mice and rabbits on intraperitoneal or intravenous injection.

Many of the strains further related themselves to the arthritic process by a marked agglutination in the patient's serum.

Colonic Irrigations

In treating these patients it was recognized that eradication of the infecting flora was probably impossible. Colonic irrigations with plain water or bactericidal solutions were early found to be unavailing. *Acidophilus* milk with or without calcium lactate did not alter the proportions of the colonic strains. Coulter and I have observed a patient for more than a year. She had a typical polyarticular, progressive, infectious arthritis. There were frequent exacerbations accompanied by leucocytosis and chills. Streptococci comprised almost 100 per cent of the bacteria on her rectal wall. Cultures of her blood yielded uniformly streptococci of the enterococcus group. She improved markedly on irrigating her colon with three gallons of plain water two or three times each week. She further improved after intravenous injections of streptococci made from a blood culture strain isolated from a previous case. Coulter employed various antiseptics in the irrigating solutions without affecting the rectal organisms. The only reduction of the rectal streptococci was obtained by instilling 6 ounces of an extremely rapidly growing colon bacillus after irrigating the colon. The original predominance of streptococci re-established itself after 10 days.

A group of fifty-eight patients was studied over a period long enough to observe what remission was possible on the institution of such general measures as a low-caloric, low-carbohydrate, high vitamin diet, massage and heat, exercise and rest, tonics, colonic irrigations, non-bacterial protein injections, and removal of foci. One-half of this group made satisfactory improvement from these procedures.

Vaccine Therapy

The remaining half of this group showed

no improvement until vaccines were administered. In order to heighten the specificity of the vaccine therapy the organisms used in the vaccine were those agglutinated by the patients' serum. They were isolated from the interior and exterior of the patients' extracted teeth, from the tonsils, the prostate gland and from the rectum. Usually the vaccine contained only killed streptococci and only occasionally staphylococci. Sixty-eight per cent of this remaining, more difficult group were markedly improved by vaccine injections.

Cathartics

I never resort to cathartics. I have never seen constipation so severe as not to be amenable to diet and good habits. A cautious trial is made with killed brewer's yeast. If the yeast is tolerated it is given to improve the tone of the bowel and to increase the strength of the peristaltic movements. Its desirable vitamin B and vitamin G effects have been extolled by others. Occasionally I prescribe mineral oil but I use that very sparingly because of the danger of its interference with the absorption of vitamin D.

Hirschman⁽⁶⁾ has called attention to chronic infections of the crypts of Morgagni. These may act as sensitizing foci. He calls the condition anal cryptitis.

A spastic sphincter may be the key to a so-called constipation. Even small hemorrhoids should be removed. Fissures should be cared for. The sphincter should be dilated under gas. Properly treated spasm does not usually recur.

Conclusions

The physiology of the various parts of the gastrointestinal tract may be significantly altered in rheumatism.

The rôle of infections of the adnexa and the removable parts of the gastrointestinal tract in arthritis is familiar even to the laity. The possibility of swallowed, unharmed streptococci either as transient flora or as growing and constant inhabitants of the bowel playing a part in arthritis because of their inherent virulence, an absence of the normal protective mechanism or increased bowel permeability must be considered as possible explanations for the presence of intestinal streptococci in the blood in rheumatism.

Vaccines of carefully selected intestinal streptococci are very helpful in the treatment of chronic arthritis.

122 So. Michigan Ave.

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Discussion

Dr. R. G. Snyder (New York): I agree with Dr. Traut that a very large number of our cases of chronic arthritis suffer from achlorhydria, and that, when this condition does exist, they are definitely benefitted by the administration of relatively large doses of hydrochloric acid after meals.

We have found that a surprising number of cases suffering from what seems to be low grade infection in their gastrointestinal tract have an associated paranasal sinus condition. We have noticed, and the patients frequently volunteer the information, that their gastrointestinal symptoms become worse or improve according to the condition of the sinuses and the amount of post nasal discharge. Practically all of these people swallow some part of the post nasal discharge, and, this, undoubtedly, in many cases, results in carrying the infection down into the gastrointestinal tract.

In regard to the importance of bacterial examinations of the stool, I must admit that I am not an enthusiast over this procedure. I take this position because a thorough and competent examination of the stools is a long drawn out procedure which can only be carried out by an extremely competent bacteriologist. This makes the examination, under the best of conditions, a very expensive one and definitely out of the reach of the average patient.

In my office practice, I make a routine examination and culture study of the stool, employing material obtained during a colonic irrigation. The bacterial findings are often confusing, and it is difficult to determine which of the various organisms found in the stool is the offending one. On account of the complexity and uncertainty of the bacteriologic findings, I feel that it is not wise at the present time to place too much emphasis on bacterial vaccines obtained from the intestines as a method of treatment, because, even if one does obtain a good result following the administration of such a vaccine, it does not follow that one would not have obtained an equally good result had one used a stock mixed vaccine.

Apart from this word of caution about becoming over-enthusiastic over specific vaccines obtained from the intestines, I can only express my sincere appreciation of this valuable paper.

Dr. Horace W. Soper (St. Louis, Mo.): There is one point that I should like to emphasize. The doctor stressed the relationship between achlorhydria and some forms of chronic arthritis. I should like to verify that these cases are very amenable to treatment by the administration of large doses of hydrochloric acid. I found one or two dram doses given in cultured milk the best vehicle for it. Some years ago I pointed out that particularly when we found nephritis and organic diseases as well as in chronic arthritis, closer study of the gastrointestinal contents showed that it was an antacid gastritis associated with a low-grade chronic enteritis. At any rate, I believed at that time, and I believe yet that it is a real focus in the absence of normal hydrochloric acid contents, and that in time the gastroenteritis develops and acts as a real focus of infection, involving the gall bladder and frequently causing chronic arthritis.

Dr. Eugene F. Traut (closing): I share the discussors impression as to when and where to employ colonic irrigation.

The point made by Dr. Snyder regarding the relationship of postnasal drip, postnasal catarrh, and infection of the upper respiratory tract to infection in the colon is something that we have thought about for a long time. How to prove that these organisms have anything to do with the organisms found in the bowel or with the organisms causing arthritis is a real problem; or that the toxins in this postnasal drip have anything to do with it is the difficulty. I am trying to find a way to prove that. Several discussions have been brought forward hooking up the streptococcus in the nose and throat and in the bowel, but how can anybody prove that they are the same organism? To take two organisms and prove that they are from the same strain, or source, is an absolutely bacterial impossibility, regardless of the agglutination or any other method employed.

I agree, too, that the action of the vaccine, no matter how it is made, may be entirely non-specific. I do not know that it has any relation to the cause of the disease. However, other foreign proteins and other vaccines that I used did not give relief to the same degree. I think, too, there is the possibility of getting lopsided on this and becoming too enthusiastic.

I was interested in Dr. Soper's remarks. They sounded very familiar, and I am glad he stressed the point that it is often due to an absence of hydrochloric acid in the stomach.

THE TREATMENT OF THE COLON AS THE FOCUS OF INFECTION *

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In discussing the treatment of the colon as a focus of infection, we must first emphasize our sincere belief that no single type of treatment will ever be found which will be satisfactory to use, even in a large majority of cases. Treatment of each patient must be highly individualized, and every possible factor related to the systemic effects of the bowel toxemia, in addition to the local pathology of the colon, must be thoroughly studied.

We are now reopening a field continuously investigated for the last 25 or 30 years and this with few convincing results. For several years various types of therapy seemed to hold the center of interest. All of us remember the widespread use of bacillus bulgaricus many years ago. Chaplin and Bettiger, and others demonstrated that a growth of this organism cannot be maintained in the intestinal tract of man. Later, the use of acidophilus with or without administration of lactose or dextrose became widespread. Bassler and Leuts, in 1922, rather accurately described the limited use of this therapy in intestinal disorders.

It seems, however, that the idea of the bacterial content of the colon acting as a focus of infection is not new. Bouchard, in 1894, in a general way drew attention to intestinal toxemia of bacterial origin. Adami, in 1899, pointed out the more or less constant invasion of pathogenic or non-pathogenic bacteria through the intestinal walls of animals with lodgment in the mesentary glands or in tissues of the body far distant from the colon. This he described as a sub-infection. Beveridge, in 1905, reported upon the apparent etiologic relation of gastrointestinal infection to arthritis. In those cases of dysentery from which he was able to isolate micrococci there was an associated arthritis. In those cases free from joint manifestations, the cultures were negative.

From time to time in the thirty years which has followed, there has appeared a few in-

teresting contributions in the literature, and here and there some indices of progress in the diagnosis and treatment of infections of the colon. An important contribution was made in 1917, when Soper reported 50 cases in which there existed pyogenic infection of the mucosa of the rectum and sigmoid with resulting systemic effects. In twenty-three cases, ranging in age from twenty-one to forty-nine years, he noted symptoms usually ascribed to autointoxication and neurasthenia. In twelve, migraine and spastic constipation were the predominating symptoms; in ten cases metastasis occurred, causing either appendicitis, cholecystitis, gastric and duodenal ulcer, or kidney disease. In this group of cases there was a tendency to rectal hemorrhage. In seven cases, nephritis and arthritis deformans were the principal conditions noted. In this connection one must pay tribute to the pioneer work of Bassler for his thought provoking work in this field.

Types Difficult to Treat

The type of case most difficult to diagnose and treat is one that does not give any great evidence of gross pathology of the colon on inspection with the sigmoidoscope or on physical examination, and may or may not present unusual morphological changes in x-ray studies. We know, however, that this type of colon has a decreased tissue resistance in the mucous membrane and an increased permeability of the bowel wall to bacterial toxins. This type of colon seems to afford a more favorable field for development and growth of pathogenic organisms, or even of different strains of a single organism, which in certain-susceptible individuals may set up marked and serious changes in the function and structure of other organs or tissues in distant regions of the body. The effect may be mainly due to the fact that this patient has a specific lack of immunity to a particular organism or group of organisms, or may be explained on the theory of an allergic reaction to the offending organism.

For purposes of increasing our knowledge

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of diagnosis and treatment, a series of selected cases were systematically studied over a period of five years. In every case used for study there has seemed to be an undoubted relationship between the colon, or infection of the colon, and the systemic disease of which the patient mainly complained. In all, 314 cases have been listed. The grouping is somewhat similar to Soper's report in 1917. It is as follows:

Table 1 — Variety of Diseases Studied

	No. of Cases
Chronic colitis, resistant type.....	61
Colitis with arthritis.....	110
Colitis with toxic neuritis.....	33
Colitis with migraine.....	10
Colitis with chronic cholecystitis.....	21
Colitis with achylia gastrica.....	11
Colitis with chronic eczema.....	10
Colitis with chronic reaming pyelitis.....	10
Colitis with cardiorenal disease.....	10
Colitis with acne.....	9
Colitis with epilepsy.....	9
Colitis with hypertension.....	8
Colitis with toxic psychosis.....	6
Cholitis with toxic retinitis.....	6
Cholitis with angineurotic edema.....	3
Cholitis with sprue.....	3
Cholitis with psoriasis.....	2
Cholitis with osteomyelitis.....	2
	314

Therapy

In brief, our treatment of these cases can be divided into (1) treatment of the colon as a source of infection, and (2) treatment of the systemic factors which render the colon predisposed to infection.

The treatment of the colon as a source of infection may be grouped under three headings:

- (a) The use of vaccines.
- (b) The use of local medication of the colon, such as lavage of the colon, medicated irrigation, etc.

(c) Oral medication designed to improve the resistance of the mucous membrane of the colon, or the use of intestinal antiseptics, etc.

Vaccine Therapy. We shall treat each one of these groups separately, and discuss first the use of vaccines. Important essentials for obtaining satisfactory results in the use of vaccines are as follows:

1. The obtaining of accurate cultures from the colon by the use of a special technic.
2. The careful checking of the pathogenic-

ity of each organism identified by intradermal skin tests before making a vaccine.

3. Control tests after administration of the vaccines to obtain more accurate knowledge as to what degree of benefit was obtained by the patient. This was done in our series of cases by follow-up cultures after administration of the vaccine and by intradermal skin tests, using the same bacterial suspensions, both autogenous and stock, that were used in the original intradermal tests.

Local Medication. In our practice the local medication of the colon has consisted of simple enemata, medicated by various bactericidal agents, such as $\frac{1}{2}$ to 1 per cent argyrol, weak solutions of Metaphen, Merthiolate, Acriflavin, etc. Two-way irrigations and high colonic therapy are used in selected cases with great caution and by well trained operators. We do not believe that this method of therapy is one to be used by technicians at large, or even by the profession without thorough study and careful training.

Oral Medication. An extraordinary number of compounds, drugs and therapeutic treatment have been used in intestinal therapy. In this discussion we will mention only two.

1. Kaolan and its compounds. I need hardly go into detailed discussion in regard to this substance, its antiseptic and healing properties in the alimentary tract are well known. It is undoubtedly a dependable and valuable agent, and can be taken over long periods of time.

2. A less known and newer type of medication includes the various neutral soaps, which undoubtedly *in vitro* are valuable antiseptics. We have endeavored to critically pursue our studies with an idea of clinically evaluating the practical effect of sodium ricinoleate or castor oil soap, which is now commercially marketed, and of other soaps, particularly cocoanut oil soap, and rosin soap, i. e., sodium abieate.

Impression of Results

With the limited time at my disposal, I can only summarize the results of our various studies. In 1930 I reported the relative advantages of a technic for obtaining cultures from the mucous membrane of the colon. The work in our clinic led me to believe that a lavage of the mucosa of the colon with sterile water through the colon tube after the contents of the bowel had been completely removed by to and fro irrigations, gave the most

dependable and accurate cultures as compared with other methods. We were able to pass the colon tube in a group of cases into the proximal portion of the bowel or into the cecum, and thereby compared the cultures from that portion of the bowel with the cultures obtained from the rectum and sigmoid region. We also compared the culture reports taken by this method with the reports obtained when a specimen of stool was sent for culturing, and also when a specimen was obtained by lavage through a duodenum tube, as advocated by Bassler.

From a study of this data we arrived at a conclusion that the most virulent organisms grew in or on the mucosa and were not found in the debris and residue of the stool. Organisms were more likely to be found in the crypts and folds of the intestinal wall than upon the surface area, and that in all probability a chronic infection occurred in patchy areas, or spots where the cellular resistance of the epithelium had been broken down. It was also found the number and virulence of the infection in the average case was greatest in the cecum or proximal portion of the bowel and that the organisms grew less toward the distal portion except in cases of localized ulceration of the rectum, sigmoid, and in cases of diverticulitis confined to the sigmoid and descending colon. Of particular value in obtaining diagnostic cultures by this method was our ability to distend the colon by means of the injection of sterile water and to syphon back this clear mucosal washing which we felt had penetrated the crypts and folds of the bowel wall. Our later studies have confirmed our impressions in regard to this technic which, while having the disadvantage of requiring skilled operators and of being a complicated technic, does not produce the inconsistency and lack of accuracy of cultures obtained by using the formed stool or the second loose stool after cathartics or by the use of sterile swabs and gentle friction of the mucosa through a sigmoidoscope, and seems more practical than flushing the small intestine through a duodenal tube.

The use of the colon tube for this purpose especially when passed into the proximal portion of the bowel was controlled by x-ray observation in a large majority of our cases, particularly those that presented any difficulty.

A year later we published a second report particularly emphasizing the use of vaccine as

a treatment of these infections, with special reference to the value of the intradermal skin tests in making up the vaccine and in determining whether its use had been effective. We believe that in approximately 20 per cent of these patients the intradermal skin test will be of very little value, either because the patient is a nonreactor or because of some factor unexplained or beyond our present knowledge. But it is of sufficient value in a large enough percentage of cases to be used routinely. However, in all cases, control tests were done, using stock suspensions along with the autogenous cultures. We showed in this report that a certain percentage which showed no improvement either in the intestinal flora or in sensitization to their pathogenic organisms, after the administration of one vaccine, could be materially or permanently improved after the administration of a second or third. Particularly in the group of cases classed as arthritics were the symptoms alleviated, when finally streptococci were eliminated in the cultures and the patient was negative to the skin test.

Comparison of Treatment

In the same report it was shown that a series of cases were studied with the idea of determining the effect on cultures and on skin tests by using, oral therapy alone, in the nature of sodium ricinoleate, sodium abietate, and coconut oil soap. Briefly, the effect of this therapy alone was very disappointing. While coconut oil soap shows the greatest bactericidal value in the test tube, we easily explain its lack of therapeutic value in the intestinal tract on account of its high ratio of absorbability. The absorbability of sodium ricinoleate and sodium abietate is not definitely known. We believe, however, that ricinoleate is somewhat absorbable and that abietate is practically not at all. Sodium abietate is tolerated in much larger quantities by the patient than is ricinoleate. The following Table 2 will give some idea and is, of course, only a rough estimation of the comparison of the use of the two soaps given to 50 cases of average similarity.

In June, 1933, a third report was tabulated by our clinic. We had begun to feel that in sodium abietate, a rather new product which had not been reported elsewhere in the literature as having been used before in human medicine, we had found a rather valuable

Table 2 — Comparison of Therapeutic Effect of Ricinoleate and Abietate Soaps

	Ricinoleate	Abietate
Average daily well tolerated dose	11 grs.	16 grs.
Length of time administered	8 mos. avg.	11 mos. avg.
Percentage of cases showing improved culture reports in one month	12 per cent	21 per cent
The above cultured in 4 to 6 months	50 per cent	62 per cent
Improvement in intradermal skin reaction within one year	44 per cent	57 per cent

agent. Additional bacteriological tests were done *in vitro* and compared with those both published and our own when using cocoanut oil soap and sodium ricinoleate. The laboratory reports showing the bactericidal value of these soaps *in vitro* were reported by Walker in 1925, Tilly and Shaffer in 1925, Kozlowski in 1928, and Hunter in 1930. Tilly and Shaffer used these soaps both on typhoid organisms and various strains of streptococci, comparing their activity to that of 1 per cent phenol.

Table 3 — *B. Typhosis*

	Dilution	2½	5	7½	10	12½	15
Phenol	1-95	+	+	—	—	—	—
Castor oil soap	1-20	+	+	—	—	—	—
Cocoanut oil soap	1-40	+	—	—	—	—	—
	1-60	+	+	+	—	—	—
	1-80	+	+	+	+	+	+

Table 4 — *Streptococcus Hemolyticus*

	Dilution	5	7½	10	12½	15
Phenol	1-90	+	—	—	—	—
Cocoanut oil soap	1-2,000	+	+	+	—	—
Phenol	1-90	+	+	—	—	—
Cocoanut oil soap	1-1,000	+	—	—	—	—

Table 5 — Cocoanut Oil Soap* (by Hunter)

Dilution	1 min.	2 min.	5 min.	10 min.	20 min.	Control
1-100	—	—	—	—	—	+
1-200	—	—	—	—	—	+
1-250	+	+	+	+	+	+
1-300	+	+	+	+	+	+

Medium: Calcium carbonate broth.
Organism: Streptococcus Viridans.

Table 6 — Sodium Ricinoleate*

Dilution	1 min.	2 min.	5 min.	10 min.	Control
1-100	—	—	—	—	+
1-200	+	—	—	—	+
1-300	+	+	+	—	+
1-400	+	+	+	—	+
1-500	+	+	+	+	+

Medium: Calcium carbonate broth.
Organism: Streptococcus Viridans.

Table 7 — Sodium Abietate*

Dilution	1 min.	2 min.	5 min.	10 min.	20 min.	Control
1-10	—	—	—	—	—	+
1-100	+	+	—	—	—	+
1-200	+	+	+	—	—	+
1-500	+	+	+	+	+	+

Medium: Calcium carbonate broth.
Organism: Streptococcus Viridans.

* Method: Three loops of a 24-hour calcium carbonate broth culture of streptococcus viridans were exposed to the desired dilution of soap in calcium carbonate broth for the stated time, after which subcultures were made by inoculating 3 loops into calcium carbonate broth. Lack of growth after 72 hours incubation indicated inhibition of growth.

The effect of these soaps on the colon bacillus, noted by Hunter, and in similar tests, showed no inhibitory effect whatsoever in the growth of bacillus coli after exposure to the soap. However, bacillus coli hemolyticus after exposure to sodium abietate showed a marked diminution in its hemolytic properties. This is interesting in view of a paper read by Niles and Torrey, in Washington, before the American Congress of Physicians in May of this year, in which they reported a hitherto unknown degree of pathogenicity of bacillus coli hemolyticus. I have found no reference in literature or found no bacteriologist who has knowledge of a substance which will inhibit hemolytic forms of the colon organism, and if abietate proves to have this property, it may be of real value in the treatment of intestinal infection where the flora is predominately hemolytic.

The second grouping of the treatment might be classed as systemic or constitutional—a secondary consideration. This need hardly be mentioned, as the clinician of today is fully aware of the relationship of various disturbances of the body to decreased tissue resistance, to lowered functional disturbances, to lowered immunity, and to the development of sensitizations to various proteins or toxins. Nevertheless, in the profession at large, it is often the case that minor considerations of the body as a whole are passed over superficially. I refer particularly to exhaustion of the endocrine system, to disturbances of calcium and phosphorus metabolism, to the management of a disturbed motor activity of the bowel, to early impairment of the cardiovascular renal system, to hidden and mild surgical or functional diseases of the abdomen, other than of the alimentary tract, and last, and of great importance, psychic disturbances and other manifestations of the nervous system. No enzyme or hormone, however inconse-

quential, should be overlooked in the survey of the body if one is to produce a permanent and lasting cure of a deeply implanted colon infection.

Summary

No one type of treatment is sufficient in this

class of difficult cases. We report excellent results when using combined therapy, consisting of oral antiseptics, colon medications, and vaccine therapy, together with an extremely thorough diagnostic survey of the entire body, and an elimination of all secondary factors.
1801 Eye Street.

THE ENEMA AND COLONIC LAVAGE *

HORACE W. SOPER, M.D.

ST. LOUIS

The clinical indications for the employment of solutions introduced into the rectum needs clarification and general revision. The enema may be considered as consisting of three classes. First, the cleansing enema for the removal of fecal matter; second, therapeutic solutions designed to influence the general system or the colonic mucosa; third, the nutrient enema.

The Cleansing Enema. The ordinary enema of water or soapsuds for the immediate evacuation of colonic contents is useful in acute conditions. The habitual use of the enema for chronic constipation is not to be recommended inasmuch as it may produce injury to the colonic mucosa, as emphasized recently by Friedenwald and Feldman.⁽¹⁾ Moreover, infectious material is likely to be introduced, and last but not least the water or saline solutions are readily absorbed by the colonic mucous membrane. A toxic solution of fecal matter is thus produced. Furthermore, the patient is deprived of the use of any rational method for the restoration of colonic function.

In cases of severe atony and dilatation of the lower colon, the daily use of an evacuant enema may be imperative. In such conditions the solution should not consist of absorptive material. The original experimental work of Goldschmidt and Dayton⁽²⁾, which has been confirmed by others, developed that the colonic mucosa was impermeable to the passage of the sulphates while the chlorides and other salts quickly passed through the wall of the colon into the blood stream. Therefore, if

it is necessary to use the enema habitually in cases of extreme atony of the colon, I recommend the employment of a three to five per cent solution of sodium sulphate. Meltzer found that solutions of sodium sulphate incited contraction of the gut, while solutions of magnesia sulphate produced a relaxation or dilatation of the intestine. In emergencies and in postoperative conditions when we know a spasmodic tendency is present in the lower colon, the magnesia sulphate enema (10 per cent solution) is useful.

Colonic Lavage. The colon is readily lavaged by the same method employed in gastric lavage. All the apparatus that is necessary is a large glass funnel to which is attached a large caliber stomach tube. The funnel is raised and lowered in the same manner employed by the Roentgen-ray technician in the administration of a Barium enema.

If the sodium sulphate solution is employed, one will secure a larger quantity of fluid than was introduced and fecal matter is more easily evacuated without danger of absorption of toxic material.

Colon Irrigation. I have discussed this subject elsewhere.⁽³⁾ Suffice it to say that the procedure is not productive of good results. It is based upon a wrong concept of the physiology of the colon. Moreover, reliance on irrigations deprives the patient of those measures which are so essential in the restoration of colonic function.

The Nutrient Enema. The introduction of the ordinary foodstuffs per rectum has been practically abandoned because of the failure

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 15, 1933.

of the colon to absorb and utilize them. Water, weak solutions of alcohol, normal saline solution, and three per cent solutions of glucose are readily absorbed and utilized. The Murphy drip method is to be preferred, but in some patients with sensitive anal canal reflexes it is better to slowly introduce about four ounces of the fluid every three hours.

The Therapeutic Enema. The use of chemical solutions, formerly much in vogue in the treatment of dysentery, ulcerative colitis, etc., should be abandoned. They all produce irritability and spasm of the colon, and aggravate rather than cure the disease. *

The Oil Enema. The oil retention enema has definite clinical indications. The dose is usually six to eight ounces introduced through a 28 F. ordinary urethral catheter to which is attached a large rubber valve bulb — a simple apparatus which the patient can easily use. The oil is given at bedtime with instructions to retain it all night. I demonstrated many years ago that the oil quickly reaches the caecum⁽⁴⁾. We formerly employed cotton-seed oil but observed that some patients developed a fatty acid dermatitis from its use. We found the mineral oil to be a great improvement, inasmuch as it is not absorbed and furthermore has the great advantage of inhibiting or discouraging the growth of bacteria. It is of great value in patients suffering from recurring attacks of subacute ulcerative colitis. Spastic contractures of the lower colon respond favorably to it and the symptoms of mucous colitis are often completely allayed. It is also of great value in the treatment of colonic diverticulosis. A series of oil retention enemas is the best preparation for the patient who is to be operated upon for carcinoma and other chronic lesions of the colon.

3701 Westminster Place.

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Discussion

Dr. R. L. Sexton (Washington, D. C.): I think that Dr. Soper's paper is probably of more practical value than any paper on this program, because it goes back to every-day treatment. I know that there isn't anyone in this room who

uses, or directs the use of enemas who does not sometimes wonder whether it should be simple or elaborate, whether it should be a salt solution or a soda solution, whether it should be oil or medication antiseptic, or whether or not to give it at all. I am sure he agrees with a great many of us that it takes a great deal of judgment and long experience to decide whether or not to use enemas at all. By enemas I mean irrigation, high, low, simple or elaborate. I think that such a common, every-day procedure requires almost as great skill and judgment as a decision as to whether or not to open the abdomen in the case of grave, acute, surgical diseases of the abdomen, although it is a simple, every-day procedure. To be sure the deleterious effects on the patient are not quite as grave should we make a mistake, but, on the other hand, we should try to formulate our best judgment and to use extraordinary diligence and skill in directing these procedures.

I hope that if possible we have more of this type of discussion and more of these papers. I wish that Dr. Soper could have discussed more the use of the newer antistreptococcic antiseptics, such as metaphen and Mercolate that are supposed to be non-toxic even if absorbed. We hardly know whether or not they are absorbed, at least in the laboratory they are extremely bactericidal in the presence of streptococci and we wonder whether or not weak solutions of them in the bowel do just as good work as they do in the laboratory. I hope that Dr. Soper will take time to elaborate on the use of those if he has had any great experience with them.

Dr. B. Billman (Cincinnati, Ohio): I am treating a physician who has complained of early symptoms of bursitis, and an intermittent skin lesion of his hand. He has observed over a period of years that the above symptoms are preceded by gastric disturbance. His wish for colonic irrigation was the reason for its use and the fact that improvement followed its application is the reason for my present interest in the subject. We began to investigate the scientific basis of colonic irrigations, and I was astonished to learn that laboratories in my city knew nothing about the bacterial findings of the colon. I want to ask Dr. Soper how best to detect the aggravating organism.

My second question is this: Knowing that we have a definite organism that is serving as a toxin for an autotoxin, and we destroy that toxin, we are in all probability destroying the bacillus acidophilus, bulgaricus, and the other bacteria or yeast organisms that tend to promote a better digestion of certain foods as cabbage and lettuce. Should we follow the destruction of a pathologic organism with an infiltration of favorable organisms, and if so, what may they be?

Dr. Horace W. Soper (closing): With reference to Dr. Sexton's question on the newer antiseptics, I have probably gone too far in that direction. One often does go too far in his therapeutic measures and omits valuable procedures because, for one reason or another, he has not

gotten results, or he has become prejudiced against the method. But I have abandoned the use of all enemas and irrigations except as I stated. You know the use of the retention oil enema. I go so far as to say that I have shown the most splendid results in changing the bacterial flora by the persistent use of the oil enemas. Mineral oil discourages the growth of bacteria in the colon, and it smooths out all spasticity. The patient does not have to use the cathartics and the other methods that may irritate the colon. That is in combination with dietetic measures. For example, the high vitamin, smooth diet, free from roughage, and general correction of bad habits, hygienic treatment, et cetera. I say that I might have gone too far, but that is my position today. I do not rely upon vaccines I probably have in this respect also gone too far, but I no longer use them.

I believe in local treatment by the use of oil enemas. Where there is pyogenic infection, local treatment through your sigmoid will stop the lesion, whether you use the insufflation powder or silver nitrate, or whatever you may use. I strongly believe in those local treatments.

I should like to ask Dr. Sexton to answer the question about the bacteriology and the use of favorable organisms, because he is more qualified to do it than I.

Dr. R. L. Sexton: Those are the very problems that led us to undertake these studies. For example, I would send a specimen of a stool to three different laboratories and I would receive three different reports. I quite agree that our laboratories know very little about the bacteriology of the colon, or at least they knew very little about the culturing, to determine whether it contained or not pathogenic organisms.

We found that the specimens of stools contained all sorts and variable culture, and that led us to discard the reports. We found that obtaining of cultures by the sterile swab gave definite, constant results, and that a predominating organism, such as streptococcus or staphylococcus, later, if given as a vaccine or checked by skin tests, actually did prove that it was the offending organism. Unfortunately, you cannot pass a sigmoidoscope or a proctoscope far enough around the colon to reach all lesions. In fact, there is a great deal of evidence in the literature that the number and virulence of the organisms in the case of chronic lesions of the rectum and the colon, and the very pus that you actually can see, decrease from the cecum downward. It is the cecum that contains the most pathogenic material.

Startling results were obtained when we performed appendicostomies in a series of four

cases, but you can't do an appendicostomy on every nervous patient, nor on every migraine headache. We saw better results after the second loose stool was obtained, especially when we introduced a pint or two of water through the duodenum tube. Difficulties with duodenum tube were soon apparent. Patients refused or could not cooperate, hence we resorted to the colon tube.

We lavaged the colon until clear, colorless washings were obtained. That was interesting. We then began to select our cases and to critically study the effect in about 200 cases. This required several years of investigation. To determine whether the skin test was of any value, we obtained much aid from the literature and much personal help from our contemporaries. Selecting those cases in whom the skin test seemed of some value as a check against the cultures, we were able to get some standard, constant, consistent reports out of the bacteriological cultures.

Regarding instillation of a favorable organism, such as acidophilus, in the colon after treatment, we tried that without any practical results. In the first place, it cannot be maintained until your chemical media in the bowel is favorable to its growth, and when you develop a colon favorable to their growth they will grow themselves. Instillation, therefore, is not necessary. Besides, it is painful and irritating to the patient, and expensive and troublesome. For nearly two years we prescribed acidophilus by mouth, by rectum, and in every way except by baths. The results did not justify the effort. We obtained cultures through the Department of Agriculture, and controlled our tests in every way possible, and after many weeks of confusing and rather troublesome therapy we got growths we could not maintain.

As to the last question, whether an irrigation could kill a pathogenic organism, such as the streptococcus and staphylococcus, or some other offending variety, or whether some benign bacterial organism does not kill the colon organism, that very problem was the result of our study with selected saponified material. These soaps have no effect on colon organisms, or upon so-called helpful bacteria, as shown by the comparison of its bactericidal value on typhoid. Streptococcus and staphylococcus are the chief offending organisms in the production of migraine headache or arthritis, and particularly of our focal ulcers, and influence that vast group of cases from whom we extirpate tonsils, teeth, appendices, gall bladders, most of whom have improved with surprising speed when we treated their bowels.

RECENT HYDROTHERAPEUTIC OBSERVATIONS IN ARTHRITIS *

JOHN D. CURRENCE, M.D.

NEW YORK

Certain hydrotherapeutic methods have proven to be our most valuable weapons for the combat against rheumatic affections. Under this generic term I include rheumatoid arthritis for which I have administered 200 bath treatments. The patients showed the typical fusiform swellings of the joints, which may be subdivided from an etiologic point of view into chronic infectious arthritis, and into menopausal arthritis non-infectious in nature.

Virtually all patients that have come under my observation were so seriously affected that they had to be lifted into and out of the bath tub. The duration of the disease ranged between one and eighteen years. None had any cardiac complications.

Methods Employed

The following technic was employed. The patient was immersed up to the chin in a large hydrotherapeutic tub of water at a temperature of 98 to 99 degrees Fahrenheit. For about 10 minutes the temperature of the water was gradually increased to 104 to 106 degrees. After this temperature was reached, the patient remained quiet for another 5 to 15 minutes (unless the least feeling of faintness was expressed), at which time the attendants carefully lifted the patient from the tub and placed him or her without drying on a warmed cot, wrapped a warm sheet about the body, with several woolen blankets over it to make a snug pack. The statistics recorded are only of those patients who remained in the pack for two hours. Those who complained of any discomfort or weakness were removed from the pack and their reactions were not recorded in this series, so that the final conclusions of the series are based only on patients who were given the identical hydrotherapeutic procedure, unless there was an undesirable elevation of the pulse rate. After the two hour pack, the patient was

dried and moved to a dry cot nearby, on which they rested from 4 to 6 hours.

The average systolic blood pressure before the baths was 116.3, and after removal from the pack 111.6, which would then gradually rise over a period of several hours to its former level.

There was a definite increase in the number of capillaries visible in the nail bed under a capillary microscope and the skin tension showed a variation average of 9 per cent on the mid-portion of the forehead as recorded with a German mechanical skin tension tester called the Hautspannungsprüfer.

A white blood count was taken just preceding the bath. A second white count was made after the patient was in the sweat pack one hour, and a third count was taken after the patient was removed from the pack, while a last count was made three hours later. In a few cases a white blood count was made just following the bath, and it appears that at this time there is a drop in the count below the original average. The average white blood count preceding the bath was 8,301; one hour after the bath there was an average increase of 2,679, making an average of 11,080 white cells. Two hours after the bath, the average count was lowered to 9,580, and five hours after the bath, the average count was lowered to 8,910. The highest white blood count of 9,100 was seen in one case, and 24,000 one hour after the bath; it returned to 11,000 five hours after the bath and was 7,600 nineteen hours after the bath. There were only a few cases which did not show some rise in the white blood count.

This primary reaction is usually accompanied by a distinct relief from pain at the height of the reaction. Within 18 to 24 hours there occasionally occurred a secondary reaction which I regard as a protein shock reaction due to the absorption of exudates. When these reactions do occur, the patient usually shows a rise in temperature and an increase in the white blood

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count equal to or even greater than that manifested in the primary reaction.

Differential blood counts were made before and one hour after the baths. The average polymorphonuclear leukocyte count before the bath average 67.34 per cent and after the bath 66.1 per cent. The average total lymphocyte count before the bath was 28.7 per cent and after the bath 32 per cent, showing a relative lymphocytosis during the height of the reaction.

Blood chemistry specimens were taken before and after each bath in a number of cases and the results seemed to indicate that there was a slight lowering of the sugar, urea, creatinin and uric acid content of the blood, and a slight increase in the blood chlorides. Due to dissatisfaction with the technic employed, it is deemed advisable to repeat this work before publishing definite figures.

The temperature, pulse and respiration were recorded prior to the bath and at half hour intervals after the bath. The average temperature before the bath was 98.2 degrees Fahrenheit and one hour after the bath it rose to 101.2 degrees Fahrenheit. It gradually returned to normal within three to five hours.

The average pulse rate prior to the bath was 80; one-half hour after the bath, 98, and returned to normal within three to five hours.

The average respiratory rate was 18.4, which increased to 22.6 one-half hour after the bath, but returned to the original rate within three to five hours.

Practically all cases showed profuse diaphoresis and a loss of from one to three pounds in weight during the treatment. The exact loss in weight during the treatment is not known because many of these patients were allowed to sip hot tea during the pack to enhance their reactions. Although there was a temporary loss of weight, patients who took this bath treatment two or three times per week over a

period of three to six weeks tended to remain stationary or gain in weight.

Each patient voided completely prior to the bath, and a marked diuretic effect was produced by each treatment with increased concentration and high color in the urine after the pack. It was also noted that a copious bowel movement was frequently achieved within a few hours after the pack.

The average basal metabolic rate in the patients used was minus 7 prior to the treatment, and practically all cases which received a course of treatment of three to six weeks, showed an increase in the basal metabolic rate.

Conclusions

Although the observations described were made with a systematic, identical bath and pack procedure, it is not intended that this specific procedure should be the one of choice. It is rather intended that this procedure be used as a basis for comparison. Physicians who have no access to the various types of apparatus for the production or maintenance of hyperpyrexia may be able to administer hydrotherapy on a basis to calculate their method and dosage according to individual needs. Our observations show that by a method suitable for home use, a hyperpyrexia may be produced which is devoid of dangerous consequences and available for repetition in courses two or three times per week for a period of four to six weeks, with a rest period of 1 or 2 weeks between courses. They show that a definite leukocytosis is usually produced and that metabolism is stimulated. They also show an improvement in the general circulation.

Finally, I wish to emphasize hydrotherapy should only be considered as an adjunct in the treatment of arthritis and certainly not as the sole remedial agent. Also, that hydrotherapy should be prescribed according to the effect desired on the patient rather than in a routine or empiric manner, or otherwise the results will be disappointing and possibly even dangerous.

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EDITORIALS

RADIATHERMY: A NEW TERM FOR SHORT WAVE THERAPY

Important contributions in medicine usually pass through certain critical phases during which they are constantly modified until organized knowledge establishes their final status, character, and appellation. This broad generalization is as applicable for the crystallization of our knowledge of the methods now employed in our discipline, as it has been in the synthesis of science. Physical therapy is today confronted with an experience again similar in character to that which occurred about four decades ago when the discovery of high frequency current first appeared on our therapeutic horizon. As then so now with reference to short wave radiation currents: a brilliant innovation in therapeutics is seeking recognition and conservative and intelligent direction to give it scientific character, status, and classification.

To attain this objective one must realize not only the kinship between high and ultrahigh oscillations, but also their dissimilarities. Occupying a position somewhere between infrared radiation and high frequency oscillations, short wave radiations are nevertheless more closely allied with diathermy in physical position and physiologic action than is generally appreciated. Schliephake's⁽¹⁾ contention that

their difference from diathermy is of the magnitude of ultraviolet from x-ray, is a pronouncement not borne out by fact. In action these waves are perhaps less distinctly thermal, but certainly more profound as regards conductivity or diffusibility through fat, bone, and other resisting tissues. It requires little calculation to realize that the gaps between usable ultraviolet and x-ray in terms of wavelength is as the length of years to days, for physically they are but extensions of the d'Arsonval frequencies, so modified in action as to provide new indications for physiologic restitution impossible with diathermy. Schliephake's statement is an index of enthusiasm more academic than practical, which by repetition will tend to color facts with legends and delay recognition of this revolutionary innovation in medicine.

In poetry roses may have the same pleasant odor by any other name, but in science facts of experience must be presented with such precision as to render description mathematically rigid. For want of a more specific appellation of their action rather than their nature, short and ultrashort oscillations have been designated as short and ultrashort wave (Schliephake), and as short-wave diathermy and ultrashort wave (Nagelschmidt)⁽²⁾. In America, Bierman has suggest-

ed the term "radiothermy" for general fever treatment with ultra-high frequency of approximately 30 meter wavelength. Thus we are beginning to see a duplication of the experiences encountered by the pioneers of high frequency therapy and even x-ray, a competition of terms that only adds to confusion of the issue. For lack of definite knowledge Roentgen temporarily allocated the rays of his discovery to that unknown region in mathematics — the x-unit — and called them x-rays. Usage is the only explanation for permitting this uncritical appellation to become the universal synonym for the action and nature of the mysterious rays of Roentgen. The splendid contributions in this field have, however, dramatized the mystery and the portent of these rays to such an extent that its very unknownness became an asset of no small proportion.

High frequency current, according to Bergonié, came too soon to a profession too unprepared to appreciate its possibilities. As compared with the laugh that was said to have gone around the world when x-ray presented its reasons for recognition, high frequency current was greeted with deathly silence by a world too ignorant to be anything but hostile to the thesis of its deep thermal properties. Since then it suffered more from overzealous enthusiasms than it profited from impartial, intelligent research. It passed through the baptismal experience of a number of appellations until the term diathermy crystallized the action of high frequency current. These errors should give us greater concern regarding tendencies to becloud the terminology of short radiation.

There is now sufficient evidence to realize that we are at the crossroads of a new era in electromagnetic radiation, an era pointing toward the short high frequency oscillations first studied by d'Arsonval and developed to their present efficiency by means of de Forest tubes and new electrical circuits. With the more critical demands of modern science for clarity and mathematical precision, the terms utilized to define short wave radiation must be replaced by one that is as inclusive, terse, and elastic as that of diathermy for high frequency. Anything less will encourage the growth of a mushroom nomenclature, which will add to the metaphysical rather than its physical stature. Just as the term diathermy

has been sufficiently comprehensive to permit the visualization of its local and general action, and just as surgery has placed the operative act above the implement utilized, so should it be in regard to a term or name defining short electrical radiation current.

The term *radiathermy* suggested by Kobak⁽³⁾ at once presents a composite picture of the action and nature of this form of energy. As such it is etymologically correct, terse, and comprehensive. Radiathermy (ra-dia-thermy) therefore should be synonymous with oscillations whose frequencies are between 10-100 million cycles per second or of the magnitude of 30-3 meters in wavelength. Undoubtedly, radiation with its deep thermic effects differs from diathermy. The radiathermic apparatus of the future will of a certainty provide full facilities for the entire range of wavelengths now spoken of as short and ultra-short waves, and it will be a simple matter to tune in any special wave according to the indications dictated by pathologic processes. Kobak's suggestion is timely and practical, and should meet with the approval of the committee on nomenclature of our Congress, the Council on Physical Therapy of the American Medical Association, and our colleagues abroad.

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THE SOUTHERN CALIFORNIA SCHOOL OF PHYSICAL THERAPY: AN IMPRESSION

Medical California has many things of which to be proud: Wonderful universities where the sciences and humanities are taught by scholars of high rank, hospitals so bewitching in beauty as to make the dark hours of sickness a pleasant memory, and a school for the study of physical therapy so complete in physical and intellectual equipment as to assure its students opportunity for well rounded instruction. We mention the latter place with some warmth for seldom is a passing visitor given a more colorful set-

ting for "sizing up" intrinsic equipment and still remain impressed with the harmony of its labors.

The Southern California School of Physical Therapy is dedicated to the service of medicine. Unendowed, it nevertheless maintains spacious teaching and ample clinical facilities for undergraduate and graduate students in physical therapy and laboratory technic. If a short but critical evaluation can justify a pen impression, then it must be stated that the personnel was wholesome and intelligent, and the faculty well balanced by representative physicians.

June 25th was the day of graduation of 36 students from the above mentioned school. Picture a California night in June, in the quaint town of San Gabriel. The moon was generous in size and leaned at a confiding angle of welcome. It was just enough yellow to suggest a honey quality. The spacious hall was crowded to the dim rear seats with a fluttering and happy audience. The dress motif appeared to suggest soft and white laces flanked by sturdy masculinity. The grand organ rumbled concord, peace and welcome. From the rear of the hall and toward the front marched two black begowned and hatted columns — the graduate students. The stirring tones of the organ gradually subsided and left us soft-dreaming and pleasantly tensed. The procession came to seat with a sigh of gentle content. The mood of the solemn moment appeared to lend especial dignity to the imposing stature of its dean, Dr. Worster, who pointed out the purposes and future plans of the school. Although unendowed the institution has justified its existence by the unselfish service it has offered to orthodox medicine, and desires above all its moral approval. One felt even more than heard the sincerity of the speaker. His presentation of the guest of the evening, Dr. Kobak, was more benedictory than introductory. And no matter how rational or perhaps cogent might have been the picture painted by Kobak of the moral responsibilities of the technicians and their future possibilities as a profession, we well know that throughout his oration, he was held in an emotional thralldom because of a setting so rare, so sincere, and so provocative. Whether the future of the physical therapy technician will be realized as a profession,

this we know: the executive head of this institution is implanting such practical knowledge and high ideals into those who come under his influence, that one can predict that this hope will become an actuality.

THE SCIENTIFIC EXHIBITS AT THE PHILADELPHIA SESSION

Fellows and guests who plan to attend the Thirteenth Annual Session in Philadelphia are urgently requested to visit the scientific exhibits. These exhibits comprise a special feature of this year's program, and there is every assurance that they will prove interesting and instructive. While the list is not large, the representation is a good one, and succeeding annual sessions should see the number greatly increased.

There will be four prizes given to the four exhibits, which in the opinion of the judges, are outstanding in nature. The judges committee will be made up of representatives of Philadelphia's medical schools, and in no instance will one be permitted to act on this committee if he is a member of the Congress.

The prizes: First prize, gold medal; second prize, silver medal; third prize, bronze medal. The fourth prize consists of a certificate of honorable mention.

The following is the list of scientific exhibitors:

American Medical Association — Council of Physical Therapy.

Simon Benson, Ph.D., Chicago.

William Bierman, M.D., New York.

Columbia University, Physical Therapy Department, New York, Norman E. Titus, M.D., and Associates.

John Stanley Coulter, M.D., Chicago.

K. B. Hansson, M.D., New York.

Jefferson Hospital, Philadelphia.

Josef Kovacs, M.D., New York.

Frank H. Krusen, M.D., Philadelphia.

John R. Merriman, M.D., Evanston, Ill.

C. O. Molander, M.D., Chicago.

Wm. H. Schmidt, M.D., Philadelphia.

J. Thompson Stevens, M.D., New York.

Max Thorek, M.D., Chicago.

Grant E. Ward, M.D., Baltimore.

IMPORTANT INFORMATION CONCERNING THE PHILADELPHIA SESSION

The thirteenth annual session of the Congress will probably be one of the greatest in the history of the organization. An outstanding feature will be the scientific exhibits and from all indications these should be unusually interesting and instructive to every physician who is doing even a minimum amount of physical therapy in his practice.

The program which has already been distributed has been commented upon most favorably. The wide diversity of subjects, the arrangement of the clinical conferences and general sessions, and in particular the high standing of the participants have brought in an unusually large number of early registrants. If this is an index of the manner in which the program is to be received, the attendance should exceed that of all former gatherings.

In planning this year's session, sectional meetings have been omitted except for the clinical conferences. In these general sessions, important symposia will be conducted, and so far as possible, papers dealing with certain specialties, have been grouped together. The formal opening of the Congress will be held on Monday, September 10, at 10 A. M. in the Grand Ball Room of the Bellevue Stratford. The meeting will be called to order by Dr. Albert Franklin Tyler, President, after which the invocation will be given by Rev. J. O. McIlhenny, M.A., D.A., Rector of the Church of the Resurrection. The address of welcome will be delivered by Honorable J. Hampton Moore, Mayor of the City of Philadelphia.

Dr. Seth Arthur Brumm, President of the Philadelphia County Medical Society will represent the medical profession of Philadelphia in welcoming the Congress to its city.

After the induction of the President-Elect, Dr. William L. Clark, the second annual William Benham Snow Memorial Lecture will be presented by Docteurs A. Halphen and J. Auclair of the Hopital H. de Rothschild, Paris, France. The subject of this lecture is "Pyretotherapie Par Agents Physiques Thermogenes."

The scientific program will commence on

Monday afternoon, and from then on to Thursday evening, a series of papers will be presented on many different subjects. The specialties will meet in clinical conferences on Tuesday morning and for this period only six groups will gather simultaneously for discussion of their respective problems as they relate to the physical therapy science.

Attention is directed particularly to the business session, Monday evening. Fellows are urged to be present at this meeting as numerous important problems are to be considered. A review of the activities of the last ten years will be read by Dr. A. R. Hollender.

The joint meeting with the Philadelphia County Medical Society is of special note. This joint scientific session is scheduled for Wednesday evening, in the Grand Ball Room of the Bellevue Stratford. The speakers for this occasion are Dr. Russell L. Cecil, Professor of Clinical Medicine, Cornell University Medical School, who will present an address on "The Modern Medical Approach to the Problem of Arthritis," and Dr. Hugh Hampton Young, Professor of Urology, Johns Hopkins University School of Medicine, who will talk on "Malignant Tumors of the Bladder and Prostate."

Aside from these notable events, fellows should reserve time for the Congress Dinner, Tuesday evening, September 11, and the Educational Conference, Thursday evening, September 13. The former is always an interesting occasion and this year's promises to be a very interesting one. At the Educational Conference several important matters will be considered. This meeting will be conducted under the chairmanship of Dr. William Bierman whose committee has been busily engaged in working out some of the problems which involve technicians and physicians doing physical therapy.

The hospital clinics comprise another valuable phase of this year's program. These will be held on Friday, September 14. A schedule of these clinics will be found elsewhere in this issue. The hospital clinics, together with the scientific program, thus present a complete scientific and clinical session.

Fellows are urged to make every effort

to attend this year's session. They should also invite their medical colleagues and impress upon them the fact that a most unusual program awaits them. Arrange to be present for the full five days. Write to the Bellevue Stratford for a reservation. Here's looking forward to seeing you in Philadelphia.

COMMERCIAL EXHIBITS AT THE THIRTEENTH ANNUAL SESSION IN PHILADELPHIA

The Congress is particularly proud of its list of commercial exhibitors to be represented at the Philadelphia convention. Practically all the leading manufacturers have reservations for space. Various types of new equipment will be shown, and, in some instances, radical departures from older models will be demonstrated.

The exhibitors have cooperated in many ways to make this gathering a success. Aside from this fact, the newer models of machines merit careful inspection to determine their comparative merits. Allot a certain period during the session to visit every booth. Intervals during the morning, noon hour, and

after the afternoon sessions, will afford ample opportunity to view the exhibits and this should be done regularly.

The commercial exhibitors include the following:

Adlanco X-Ray Corp., New York.
Archives of Physical Therapy, X-Ray, Radium, Chicago.
Burdick Corp., Milton, Wis.
Cameron Surgical Specialty Co., Chicago.
Davis, F. A. Co., Philadelphia.
Coward Shoe Co., New York.
Do/More Chair Co., Elkhart, Indiana.
Electrical Research Laboratories, Warren, Penna.
Electro Therapy Products Corp., and the E. J. Rose Mfg. Co., Los Angeles, Calif.
Fischer, H. G., & Co., Inc., Chicago.
General Electric X-Ray Corp., Chicago.
Hanovia Chemical & Mfg. Co., Newark, N. J.
High Tension Corp., New York.
Honsacker, C. Coy, Philadelphia.
Ille Electric Corp., New York.
Knyvett, Frank, Springfield, Mass.
Lepel High Frequency Laboratories, New York.
Liebel-Flarsheim Co., Cincinnati.
McIntosh Electrical Corp., Chicago.
Meco-Sazh Distributors, Inc., New York.
Peerless Electro Medical Corp., New York.
Sanitax Electric Co., New York.
Von Corporation, The, Los Angeles, Calif.
Waite & Bartlett X-Ray Mfg. Co., Inc., Long Island City, N. Y.
Woche & Son Co. The Max, Cincinnati, Ohio.

(Continued from page 478)

tion, or improper initial treatment. The physical therapist should not take the responsibility at any time during treatment for the care of a fracture. All changes in treatment should be on the authority of the man who originally took care of the patient. When the limit of improvement by physical methods has been reached, the surgeon should be so informed and further treatment refused. The patient must be made to feel that these methods assist him to cure himself. The most propitious time for physical therapy is in the first ten days. After this it becomes progressively of less value. There is much to be learned about the action of many forms of physical therapy, and we need close cooperation between physical therapists and surgeons to insure the best therapeutic effects in fractures.

115 East 61st St.

Discussion

Dr. William Benham Snow, Jr. (New York): Listening to Dr. Kennedy's able presentation and Dr. Murray's appropriate remarks makes me feel very fortunate in having been associated with them for several years. Unfortunately, however,

the physical therapist has to treat many cases that have not received such efficient early care. We are called upon to restore function in cases where the results show poor surgical supervision.

I would like to mention here the value of the static brush discharge associated with heat, elevation, massage and bandaging in those cases, for instance, of fractures of both bones of the leg, associated with heavy, brawny, lymphatic and circulatory stasis. The static brush discharge will shorten the disability time while under physical treatment at least forty per cent over other methods.

I would also like to stress the value of resistive exercise in these and other cases, where there is associated much muscular atrophy. Development of muscle tissue depends upon our making the muscle do increasing amounts of work, at the same time avoiding fatigue.

I wish to advocate the use of diathermy by the cuff, and saline method associated with friction massage, active and gentle passive motion in cases of periarticular fibrosis which has resulted from prolonged swelling and edema below the wrist.

I think that all of us who do physical therapy agree with the speaker in decrying the indiscriminate use of passive motion. We who teach the subject to technicians continually stress the traumatic results attending such abuse and will continue to do so.

SCIENCE, NEWS, COMMENTS

The Special Committee on Education of the Council on Physical Therapy

The Council on Physical Therapy of the American Medical Association has created a special sub-committee on education. The purpose of this special group is to act as liaison to the Council in its efforts to create wider interest in physical therapy practice throughout the United States. The members selected for this work have been chosen not only because they are so geographically situated as to carry the Council's messages to a wide radius of medical centers, but also because they form an intelligent group of physicians practicing and teaching physical therapy. Undoubtedly this is perhaps the nucleus for a more ambitious plan wherein additional men will be drafted to carry this desirable propaganda into every State and County in the Union. There are splendid individuals obtainable for this purpose and there is assurance that such selection will be made as the occasion will warrant. The names of the members forming this present group are:

Kobak, Disraeli, Chicago.

Kotkis, A. J., St. Louis.

Kovacs, Richard, New York.

Krusen, Frank H., Philadelphia.

Lowry, F. P., Newton, Mass.

Dr. Krusen, Chairman of this body, invites correspondence with any medical society wishing to present special discussion or symposium on physical therapy topics.

Dr. Levine in Arctic Region

Our intrepid explorer, scientist and humorist, Professor Victor Levine of Creighton University is at present occupying the North Pole as Admiral Byrd is the South. Levine is head of an expedition doing research work among the Esquimos and is apparently having a very interesting experience obtaining data of value to pediatricians. They have already spent the months of June and July and expect to remain in the frozen north until October. The expedition is making physical measurements of Esquimo children, determining their nutritional status, their basal metabolism, and is doing quantitative studies of important inorganic constituents and also their susceptibility to tuberculosis, diphtheria and scarlet fever. Dr. Levine states that he has traveled the northern-most arctic route with several Esquimo guides (he does not mention their sex) and is still ambitious to continue his research. That icy walls do not tend to freeze one's humor may be seen from the conundrum propounded by him. He asks: "Why is a seal unable to sleep? Because he has a flapper on each side." Sunny boy!

Office Model Sollux Radiant Heat Lamp Acceptable to Council on Physical Therapy

The Hanovia Chemical and Manufacturing Company declares that this unit has been designed to provide the physician and the specialist with a moderately priced office infrared lamp of exceptional flexibility and therapeutic efficiency.

The light element consists of a 500 watt tungsten gas-filled glass bulb or a 500 watt wire wound infrared generator, both of which are interchangeable in the lamp. The terraced reflector hood is spun from heavy gaged aluminum, highly polished on the outside and having a brush finish on the inside. In conjunction with the terraced reflector, the interior brush finish is said to be most effective in diffusing the infrared rays over a wide area. The diameter of the reflector is 14 inches. A wire screen can be provided, if desired.

The reflector cross arm member extends the hood 30 inches from the telescopic upright. The vertical adjustments can be made from 36 inches to about 62 inches from the floor. There is a combination of two swivel bearings, enabling the hood to be adjusted in practically any position. The upright is mounted on a three-legged castiron base.

In a laboratory test it was found that, by connecting the Mazda 500 watt lamp to an alternating current line having an electromotive force of 109 volts, the current read 4.21 amperes, and on a 118 volt line the current read 4.23 amperes. At 30 inches, which appeared to be a comfortable distance between the patient and the lamp, the relative radiant energy values were noted. With a thermopile, it was found that, within an area covered by a 24-inch circle on a plane (in air) perpendicular to the direction of the center rays, the radiant energy in the center was from 25 to 30 per cent greater than that of the periphery.

In a clinic acceptable to the Council, this unit was tried and found to give satisfactory service. The Office Model Sollux Radiant Heat Lamp, therefore, is included in the Council's list of acceptable devices.—*J. A. M. A.*, 103:339, (Aug. 5) 1934.

Burdick Dual Zoalite Acceptable to Council on Physical Therapy

The Burdick Corporation, Milton, Wis., declares that this unit was developed and designed to provide a source of infrared to meet every treatment condition for which infrared radiation is indicated. The resistance unit is a cylinder made of ceramic material, in which resistance wire is embedded. The current being turned on, the ceramic material heats to a cherry red. The heating unit is placed approximately at the focal point of the nickel plated reflector. The opening of the reflector is 9 inches

in diameter, and a wire screen is fitted over it. On the back of the larger unit, a small localizing unit is mounted, their reflectors facing opposite directions. The firm claims that by means of this localizing unit it is no longer necessary to heat the entire head when applying infrared to the ear or other localized area around the head.

The unit was examined in a physical laboratory. When the large unit was connected to a 112 volt alternating current line the current reading was 3.2 amperes. On 120 volts the current read 3.43 amperes. The small unit is rated at 75 watts. On a 119 volt alternating current line it drew 0.6 ampere. At 117 volts the current was 0.64 ampere. Irradiating a plane area of 2 feet in diameter (in air) perpendicular to center rays at 40 inches from the reflector of the larger unit, the intensity at the center of the area is more than twice the energy at the edges. Within an area of a circle 1 foot in diameter, directly in front but 40 inches from the reflector, the radiant heat intensity at the center was 36 per cent more than the intensity on the periphery of the same area.

The unit is mounted on an enamel base. When the upright is fully extended, the distance of the lamp from the floor is 7 feet. There is an extension range of 2 feet 6 inches. The reflector and heating unit may be placed in almost any position by virtue of the flexible gooseneck arm supporting it. The current is supplied by means of a cord on which is placed a dual switch. The two units may be operated separately or together. The Burdick Dual Zolite, therefore, is included in the list of accepted devices.—*J. A. M. A.*, 103:339, (Aug. 4) 1934.

Only Few Children Acquire Dreaded Infantile Paralysis

Infantile paralysis is the most dreaded of all childhood diseases, yet comparatively few children are attacked by it and of those few only a small proportion suffer from the paralytic form, says Dr. W. T. Harrison, surgeon of the U. S. Public Health Service, who has made a special study of the disease.

The great dread parents have of the disease is due to the very severe crippling which sometimes follows the infection. But the paralytic form of infantile paralysis is probably one of the least prevalent diseases of childhood. Even in epidemics seldom more than three or four children in a thousand are affected.

"Infantile paralysis can not be compared in infectiousness to such diseases as, for example, measles and chickenpox, to which practically all children are susceptible," Dr. Harrison declared.

"The greatest recent advance in the treatment of infantile paralysis has been made in the re-education and training of paralyzed muscles," Dr. Harrison pointed out. "The treatment should begin during the acute stage of the disease in that proper splinting of affected muscles should be done to bring about complete quiet and to prevent deformity. As soon as the pain has disappeared massage and passive movements should

be begun, followed by continued, consistent effort toward active control of muscles. Baths are valuable for the support of paralyzed members during muscle exercise. The treatment requires great perseverance, the direction must be sympathetic and expert, and can best be done by specially trained personnel not connected with the patient's family. Seemingly hopeless cripples can have a great deal of muscle function restored, but regular systematic exercise must be continued for as long as two years from the acute illness."

If there is an epidemic, young children should be kept as far as possible within their usual environment and away from crowds, he advises. The disease is most prevalent during vacation time, so only necessary travel should be undertaken by children as they should not be taken from a district where infantile paralysis is not prevalent into one where there is an epidemic. During epidemics a physician should see all children showing any sort of upset associated with fever.

Dr. Harrison spoke over the Columbia Broadcasting System under the auspices of Science Service.—*Science News Letter*, Aug. 4, 1934.

Science Takes Measure of Roosevelt Vocabulary

When President Roosevelt comes before the microphone to talk to the people about the affairs of the United States, he uses a vocabulary almost as simple as that of the famous Lincoln Gettysburg address.

This is the report of Dr. Richard S. Schultz of the Psychological Corporation in New York City, announced in the educational journal, *School and Society*.

Dr. Schultz was led to make a statistical study of President Roosevelt's radio vocabulary because choice of language is vitally important to any speaker who would mould public opinion.

Comparing President Roosevelt's inaugural address and a radio message on national conditions given October 23, 1933, with lists of the most common words in the language, Dr. Schultz found that 70 per cent of the words used on these two occasions occur among the 500 most common words found in general reading material. President Lincoln spoke even more simply at Gettysburg. Over 77 per cent of his words are among the 500 most common words.—*Science News Letter*, July 14, 1934.

Cod Liver Oil Now Used as Wound Dressing

Cod liver oil, best known for its ability to prevent or cure rickets in children and to hasten their slow convalescence from infectious diseases, has found a new use as a dressing for wounds. This new use for the familiar oil was discovered by the German Prof. Löhr as a result of three years of experimenting with thousands of cases at a hospital in Magdeburg.

Combined with other fats to make a semi-solid ointment, cod liver oil speeds up the healing of

wounds, apparently giving just that fillip that makes all the difference between sluggish and quick recovery.

Whether or not the speedier healing is a result of the high concentration of vitamin A and D in the oil Prof. Löhr does not know, though he considers it a possibility. He says the new ointment is no panacea and should not be used indiscriminately. He uses it in selected cases, pasting onto wounds, sores and ulcers a layer so thick that the overlying dressings do not come into contact with the raw, tender surfaces of the wound, thus eliminating pain when the dressings are changed. — *Science News Letter*, May 19, 1934.

Tongue Vaccination Protects Against Rabies

The tongue is the best place to vaccinate animals against rabies, Drs. John Reichel and J. E. Schneider of the Mulford Biological Laboratories, Glenolden, Pa., have found. They reported to the American Public Health Association, results of their efforts to determine the best methods of protecting animals from this horrible disease.

The relative potency of various rabies vaccines and the length of time protection will last following a prescribed number of injections of vaccine were among the points determined in their investigations. Injection of the vaccine into the brain is nearly always fatal, regardless of the size of the dose used. Other methods, such as injections under the skin or into the veins or muscles, are uncertain and give inconsistent results. Injection into the tongue was finally settled on as most satisfactory. — *Science News Letter*.

Ousted German Scholars Join American Faculties

Twenty-three dismissed German scholars have found intellectual refuge in American educational research institutions, the first report of the Emergency Committee in Aid of Displaced German Scholars issued in New York recently revealed. Grants have been made for placing twelve additional scholars.

Of the twenty-three German professors now at American universities, thirteen are scientists.

"A thrust at the very soul of the university brought into existence the Emergency Committee in Aid of Displaced German Scholars," the report declares. "Approximately fifteen hundred scholars have fallen victim to the attack. Ancient sanctions, rights treasured as inalienable and ideals achieved through sacrifice have been destroyed."

In making public the report, President Livingston Farrand of Cornell University, chairman of the Emergency Committee, declared that the emergency situation is steadily growing more complex and acute.

"The number of actual academic refugees, to-

gether with those who might be termed 'potential refugees,' continues to increase," President Farrand said. "We are desirous of rendering the maximum degree of assistance to our German colleagues. We are equally eager to refrain from policies calculated to affect adversely the positions of American scholars."

The report makes clear that funds put at its disposal by various foundations and from private sources were used for grants made to various universities, but that the individual educational institutions were given complete freedom in selecting the German scholars to be called to their faculties.

Prof. James Franck of Göttingen, the eminent physicist, was appointed by both Massachusetts Institute of Technology and Johns Hopkins University. Other scientists are: Prof. O. Szasz, mathematician of Frankfurt, at Massachusetts Institute of Technology; Prof. F. Bernstein, mathematician of Göttingen, at Columbia University; Prof. K. Lewis, psychologist of Berlin, at Cornell University; Prof. H. Lewy, mathematician of Göttingen, at Brown University; Prof. E. Berl, chemist of Darmstadt, at Carnegie Institute of Technology; Prof. E. Noether, mathematician of Göttingen, at Bryn Mawr College; Prof. Felix Bloch, physicist of Leipzig, at Stanford University; Prof. R. Brauer, mathematician of Königsberg, at University of Kentucky; Prof. H. Rosenberg, astronomer of Kiel, at University of Chicago; Prof. Walter Beck, criminologist of Leipzig, at Boston University; Prof. H. Werner, psychologist of Hamburg, at University of Michigan; Prof. Max Sulzbacher, biochemist of Berlin, at Connecticut State College.

The Emergency Committee recalls "occasions in history which offer parallels to the present situation in Germany."

"In the opinion of many students," a statement reads, "the entrance of Greek scholars into Italy after their expulsion from Byzantium in 1453 contributed to hastening the oncoming renaissance of humanism. The world is still in their debt. The emigration of the Huguenots after the revocation of the Edict of Nantes is an event which the English recall with satisfaction for their migration released new forces valuable to social and commercial development. The year 1492 marks two important events, the discovery of America and the expulsion of the Jews from Spain. What America meant subsequently to the Puritans and to the oppressed in other lands is too recent and sacred a memory to require awakening. What the other event, a reverse picture, meant by way of loss to Spain, the Spanish representative to the League of Nations recently made abundantly clear. In a sense the history of the world is a history of migrations. Practical considerations urge upon us here and now in the United States the advisability of recalling, perhaps of profiting from, these plain teachings of history." — *Science News Letter*.

THE STUDENT'S LIBRARY

THE GREAT DOCTORS. A Biographical History of Medicine. By Dr. *Henry E. Sigrist*, Professor of the History of Medicine, The Johns Hopkins University. Translated by *Eden and Cedar Paul*, Second Edition, Cloth. Pp. 436 with 69 illustrations. Price \$4.00. New York: W. W. Norton & Company, Inc. 1933.

At this moment when economic distress has created states of depressing introspection that makes one envision life as futile, void and sterile, the reading of *Great Doctors* will be the finest tonic and the saving of many colleagues from the thralldom of deep pessimism. The canvas for this story is as large as the history of medicine and as brilliant and as colorful as the personalities so vividly depicted by the author. It is the composite of a multiplicity of facets of the doctor throughout the ages in the service of mankind, whose accomplishments have ever been stimulated by highest ideals. Through these pages we see in retrospection an endless army of marching doctors—sturdy, idealistic, brilliant—striving to alleviate the pain of mental and physical suffering. They pass before our eyes distinctive in dress, language and accomplishments, yet retaining a universal likeness to each other, a sort of spiritual resemblance that awakens sympathetic echoes in the reader. Written in simple diction but scholarly in its critical evaluations, 50 great personalities pass in review, from Imhotep, the healer and faithful servant of a pharaoh, to Osler, the creative thinker and the magnetic teacher. It is seen that many hands have labored to build up the edifice of medicine, "have forged new weapons against sickness, weapons which everyone who followed after them could use . . . select men who, partaking of the divine spark, could sense and seize upon, and hew out with rigorous labor, ideas that hung in the air so that they became usable." This book outside of special appeal is a fascinating document of heroic labors, difficulties conquered, battles against ignorance and prejudices, daring research, brilliant discoveries, stout hearts climbing over insuperable obstacles—all this forming a vivid background from the dramatic personnel presented in these pages. This book should be read by every student for inspiration and every practitioner for affirmation that medicine is still an ideal calling.

PRAKTIKUM DER PHYSIKALISCHEN THERAPIE. By *Max Ostermann*, Fachartz für Physikalische Heilmethoden in Wien. Editor *Ars Medici*, Second Edition, Cloth. Pp. 458. Price 13 Shillings. Vienna: *Ars Medici*, 1934.

Every new innovation or departure from traditional paths is greeted with suspicion, but is eventually accepted with due hesitancy and then accorded unstinted acclaim. This work falls into this classification, for it undoubtedly is a pioneering venture

to include dietotherapy as part of physical medicine. That it has gained the approval of many in the profession is indicated that it now has entered the second edition, enlarged, revised and materially benefited by the new contributions in this discipline. The fact that dietotherapy has long been sailing in uncharted seas, being neither medicinal nor surgical, but truly physical and altogether an increasing and important phase of our treatment is justification for its inclusion in a fixed discipline. For this the author is to be commended for his vision and courage.

The contents of the work are divided into two broad sections—general and special. The first part is devoted to the general exposition of dietetic and physical measures—their chemical, physical and physiologic effect. The subject matter as well as the subdivisions wherein each agency is discussed is so extensive that space will not permit their enumeration. Suffice it to point out that diet, heat, light, electricity, roentgen and radium, high frequency, short wave, inhalation, massage, aero-climato- and hydrotherapy, etc., come in for special and detailed consideration. Every phase touched upon contains added information of value to medical practice. The section on short wave therapy, for instance, offers a splendid and concise cross-section of the most authoritative opinions of foreign workers. It carries one through its development period, its physical and physiologic effects and affords a clear picture of its clinical possibilities.

Where the first part dealt with general considerations, the second section deals with special application of diet and physical agents in general and special medical problems. Here the work is particularly detailed in information. In spite of being so stimulating one often becomes irritated at the lack of reference with which to pursue one's studies. With exception of name and date of the contributor, the author leaves the reader "high and dry" as regard to bibliographic data. Another fault is that the type is too small for average vision, but against this the richness of the material should be full compensation. Finally with all its virtues this work has missed the biggest opportunity because of the author's meager acquaintance with the literature of the English speaking world.

FLUORESCENCE ANALYSIS IN ULTRAVIOLET LIGHT. By *J. A. Radley*, B. Sc., A. I. C., and *Julius Grant*, Ph.D., M. Sc., F. I. C. (Being volume Seven of a Series of Monographs on Applied Chemistry Under the Editorship of E. Howard Tripp, Ph.D.) Cloth. Pp. 219. Price, \$6.00. New York: D. Van Nostrand Company, Inc. 1933.

This work is the result of an increasing demand for authoritative information on the growing topic of fluorescence analysis by ultraviolet light and un-

doubtedly has been due to the widening interest in the subject. The authors are unquestionably cognizant of this existing situation, and the urge to collect and place before a discriminating circle the interesting and profitable advances in this field is the reason for this timely contribution. Indeed it is their conviction that "there is a real and almost an urgent need for an up-to-date book which will guide the practical worker through the labyrinth of scientific papers on the subject, many of which are contradictory or too vague to be of real use." The book has therefore been written to meet the needs of the group of workers in many unrelated fields who require exact information on the nature of fluorescence in connection with their respective problems. To select from this "labyrinth of papers" (800 in number) the fundamental facts was a task not only of patience but also of discrimination. The contents are divided into two sections. The first part is concerned with theory and technic in as simple and brief a manner as possible, "due regard being paid to the pitfalls and sources of error which may mislead the beginner." The second part, forming as it does the bulk of the work is specialistic in nature, covering over 19 chapters, as compared with five in the former, and deals with the practical application of fluorescence phenomena in relation to bacteria, botany, drugs, foods, chemistry, medical and biological problems, industry, and various other fields. The facts presented have been written in clear, critical and impersonal style, and conservatively evaluated. This work is not only an authoritative compend on an interesting phase of ultraviolet radiation but is so rich in information as to make it encyclopedic in scope. There is also incorporated an extensive reference list of 800 contributions on the subject and an index.

By way of constructive criticism it is suggested that a substantial section on medical problems be included in a future edition. So much of valuable work has been published on the diagnostic possibilities of fluorescent light in cancerous and normal tissue that this feature is deserving of widest publicity and critical evaluation.

**LUMBALANÄSTHESIE IN DER GEBURTS-
HILFE UND GYNÄKOLOGIE.** Mit besonderer Berücksichtigung der Biochemie des Liquors und der Blut-Liquorschranke. (Lumbar Anesthesia in Obstetrics and Gynecology. With Special Consideration of the Biochemistry of the Spinal Fluid and of the Blood-Spinal Fluid Barrier.) By Dr. *Ernst Preissecker*, Assistant at the II. University Gynecologic Clinic of Vienna. Cloth. Pp. 76 with 2 illustrations and 3 multicolored plates. Price Marks 7.50. Vienna: Wilhelm Maudrich (American Agency: Chicago Medical Book Co., Chicago). 1934.

This small but weighty monograph fresh from the press represents a carefully elaborated study of the problem of lumbar analgesia which has great clinical value. This author has for many years endeavored to develop a technic which should be free from dangers and undesirable complications and in this he has attained his goal. As Professor Weibel, chief of the clinic in which the author is

an assistant, has stated in a short foreword, the clinical and experimental research undertaken by the author has served greatly to reduce the operative mortality. Lumbar analgesia has been administered to 1,200 patients in the clinic and the operative results certainly appear to speak for the method used by its surgeons.

No pretense is made to present a complete monograph, yet the technic has been described minutely, so much so that this chapter alone will appeal not only to gynecologists and obstetricians but to all surgeons who perform pelvic operations. The author introduces his subject with a brief historic sketch, and continues with a study of the drugs and indications, and concludes with a statistical study of the cases, not omitting those which were followed by untoward results, and which led the author to seek means to render this form of anesthesia harmless and effective. A section dealing with the barrier of the blood-cerebrospinal liquor is somewhat theoretical in character but nevertheless offers a plausible explanation of the concerned phenomena. It is presented in order to show the rationale of the employment of calcium as a precautionary measure in cases particularly subject to untoward effects. A short bibliography containing also a few American contributions concludes the small volume. We miss an index and those who master German will also note several typographic errors, but aside from these minor shortcomings the monograph is exceedingly valuable to all surgeons interested in the problem of spinal analgesia.

MAYON'S DISEASES OF THE EYE. Revised and largely rewritten by *Frederick Ridley*, B.Sc., M.B., B.S., F. R. C. S., Assistant Surgeon and Late Pathologist, The Central London Ophthalmic Hospital; Consulting Ophthalmic Surgeon, London County Council; Hon. Assistant, Institute of Pathology and Research, and Chief Clinical Assistant, Ophthalmic Department, St. Mary's Hospital, and *Arnold Sorsby*, M.D., F.R.C.S., Hunterian Professor, Royal College of Surgeons; Assistant Surgeon and Pathologist, Royal Eye Hospital; Assistant Ophthalmic Surgeon, London County Council. Fourth Edition. Cloth. Pp. 299. Illustrated. Price, \$2.25. New York: Oxford University Press; London: Humphrey Milford, 1933.

This little book is more or less of an abbreviated treatise on ophthalmology and refraction. It is doubtful whether it can serve more than for a quick reference to the busy specialist. When one desires detailed information on some important subject in the field, he naturally would be prompted to seek it in a book which dealt with ophthalmic problems in a more comprehensive and complete fashion. The information which the book contains is, however, authoritative and in keeping with present-day knowledge. There are a number of illustrations, but too few even for a small book. Ophthalmology to be made clear to the novice and even to the practitioner requires adequate illustrative material. It is difficult to understand what purpose a book of this kind can serve unless it is intended as a compend for the medical student. And even for such purpose, one has to stretch his imagination to understand how it can serve adequately.

INTERNATIONAL ABSTRACTS

Histamine in Rheumatism. F. Severn Mackenna.

The Lancet, 1:1226, (June 9) 1934.

Histamine has a definite place in the treatment of fibrositis and neuritis, and in all chronic rheumatic affections associated with pain and limitation of movement. With histamine it is possible completely to cure fibrositis and neuritis, and almost invariably to decrease or remove joint pains in other suitable cases. The process of ionization with histamine requires unremitting attention during the whole of the sitting and, even more important, the tolerance of a given patient both as to time and milliamperage varies greatly from day to day.

With the treatment the patient experiences an immediate relief from pain, either complete or partial, and can demonstrate a greater range of movement where previously there was restriction. This lessening of pain is always present and may last a few hours, a few days, or permanently. In addition there is a feeling of local warmth and general well being. The undesirable results which must be carefully watched for include headache or a feeling of fullness in the head, tachycardia, a feeling of constriction in the chest with consequent breathlessness, burning, and faintness, any one of which is an indication for the immediate cessation of the sitting. Treatment may be given daily.

Biterminal Active Electrode for Skin Work. Herman Goodman.

Urol. and Cutan. Rev., 37:862, (Dec.) 1933.

It is important that both terminals of the new electrode be equally active to produce a uniform zone of coagulation. The current from the high frequency machine must be of low voltage. The machine must have a capacity from the outlets of the oscillating circuits uniformly distributed relative to ground. Some commercial apparatuses for high frequency have a definitely higher voltage relative to earth at one terminal than the other. The effect of this is to produce a greater activity at one tip of the bi-terminal active electrode than at the other.

With the bi-terminal electrode it is possible to actually see the action between the two imbedded active tip electrode terminals. The setting of the machine which gave the best control of the current was soon established. In clinical practice one can use a piece of bar soap or a piece of meat for this test. Too much current acted to cause carbonization and sparking between the two tips of the electrode, and too little current caused separate areas of coagulation around each electrode tip. Machines which were improperly constructed or which were not in balance and

hence not adapted to the new bi-terminal technic caused one tip to be active and the second tip was the inactive electrode. The best results are obtained if the coagulation area is limited to the tissue between the two tips and a very narrow area about them. Multiple insertion becomes the rule, except for very small areas to be treated, namely, less than four millimeters.

Tonsil Electrocoagulation With the Bi-Active Electrode. J. B. H. Waring.

Vir. Med. Mon., 60:630, (Jan.) 1934.

Perfect coagulation may be produced with approximately 1,200 milliamperes with the bi-terminal electrode; not only this, but the double needles cover the ground of coagulation much more rapidly, and with very little discomfort to the patient. One unhandy step in this technic was the operator's inability to retract the anterior pillar on the treated side, depress the tongue and manipulate the electrode without assistance. With a pillar retractor in the hands of an assistant, it was somewhat difficult still to secure efficient pillar retraction at all stages because the assistant could not well see into the throat with the operator's head in front of the patient's mouth.

To eliminate this difficulty, the author developed a combined tongue depressor and pillar retractor, termed a tonsilloscopic tongue depressor. The instrument has been largely redesigned, with complete elimination of the defects noted in operation of the first model. Now we have a combined tongue depressor and pillar retractor, held in one hand of the operator for perfect exposure of either tonsil, while the other hand is free for operation of the electrode. This new instrument has eliminated the last difficulty encountered in this technic, and, in addition has proven of great value in surgical tonsillectomy.

The X-Ray and Diathermy Treatment of Prostatitis and Hypertrophied Prostate. S. D. Whitten.

Tex. S. J. M., 29:442, (Nov.) 1933.

Before adequate treatment can be considered, thorough physical and laboratory examinations should be made and history taken. Treatment should include the same preparatory procedure used for surgical treatment. All hygienic measures should be scrupulously carried out: water internally and externally should be forced. The excretory organs should be performing normally, urinary antiseptics being used as necessary, and a proper diet instituted. Irrigation of the bladder is carried out if it has become infected. The x-rays are used in fractional doses through several ports of entry and at frequent intervals, instead of the

massive dose. In regard to the diathermic treatment the author says that "the supplementary diathermy applications are begun as soon as radiotherapy is completed and are given daily or every other day over a period of three or four weeks. In cases where the prostate is small and hard it is often sufficient to use only the combination of diathermy and Morse wave, as the x-rays have but small effect on purely fibrous prostatitis." Surgical interference is called for in almost all cases of senile prostate where there is much residual urine, definite enlargement into the bladder as proved by cystoscopic examination, cystitis or evidence of back pressure affecting the kidneys. Where the above conditions are not present, x-ray therapy and diathermy are to be employed. In the case of the small, hard prostate, diathermy alone gives satisfactory results. X-rays and diathermy are also indicated in early cases of hypertrophied prostate, in which the heart, lungs, general condition or age of the patient contraindicate surgery, and when the patient or his friends will not submit to surgical interference.

The Effect of Ultraviolet Light on Photosynthesis. William Arnold.

J. Gen. Physiol., 17:135, (Nov. 20) 1933.

An unidentified unit in the mechanism of photosynthesis of *Chlorella pyrenoidosa* is rendered inactive by the absorption of one quantum of ultraviolet light (2537 Å wave length). The same irradiation has no effect on the normal respiration of *Chlorella pyrenoidosa*. Experiments have not yet been made on the respiration inhibitable by HCN. No chemical change was detected in the chlorophyll extracted from irradiated cells.

Posture. A Standard for Anterior Posture. C. Ulysses Moore.

Am. J. Dis. Child., 47:488, (March) 1934.

The adoption of easily applied standards for posture, the arousal of a 100 per cent interest in posture on the part of the medical profession and the stimulation among teachers and lay organizations of greater interest in prevention and correction of incorrect posture are eminently desirable. But these are of mediocre value unless followed up by the physician who can give instruction regarding mineral metabolism, dietary balance and normal health habits. What does it matter if by certain exercises or by special devices the physician gets the scaphoid bone back in place so as to correct a flatfoot if he does not at the same time increase calcification of that bone and its abutting fellows so as to enable them to hold their places permanently? I grant that severe physical deformities are orthopedic problems. But are not the mild cases and those in the initial stages of an insidious onset primarily pediatric?

Proper posture, therefore, signifies physical perfection, the importance of which challenges the interest of both physicians and laymen.

Standards for anterior posture comparable and complimentary to the profile forms are suggested which permit anteroposterior grading. The application of both these profile and anterior standards to several hundred children indicates that a person deserving an A-1 grade is extremely very rare. Grading and correction of posture should be combined with careful attention to mineral metabolism.

Shock, Collapse and Electrosurgery. F. Schörcher.

Deutch. Zeitsch. f. Chirev., 243:225, (May 14) 1934.

Schörcher defines shock as a clinical state resulting from a sudden trauma of the nervous elements influencing the central nervous system by way of the reflex arc. It is accompanied by a rise in the blood pressure, followed later by a fall. Collapse, on the other hand, while clinically similar to shock, differs from it casually in that it is the result of a chemical action. It is caused by the absorption of toxic substances and their effect primarily on the circulatory system. It is slower in development and is characterized by a primary fall in the blood pressure. The author conducted studies of the circulation in rabbits and dogs in a state of experimental shock. Shock was induced by traumatization of the skin and the muscles, by trauma of the nerves and the vessels of the peritoneum and by procedures on the spinal cord and the internal viscera, especially the kidneys, the testicles and the uterus. He found that the circulatory system did not always react in the same manner. Not infrequently the fall in the blood pressure and the slowing of the pulse preceded the rise in the blood pressure and the acceleration of the pulse. As a rule, however, the fall in the blood pressure was secondary to an initial rise. The blood pressure fell, as a rule, in abdominal operations. The same experiments were performed in rabbits in which both hemispheres were removed as well as in animals in which the spinal cord was severed at the level of the neck. The effect was identical. The severing of both vagi did not change the effect. When the area to be traumatized was anesthetized by infiltration, no shock or any evidence of circulatory disturbance was noted. The author further found that trauma of the electro-surgical procedure produced less shock than that produced by ordinary mechanical means. In his studies on collapse the author showed that the so-called rapid toxins of the defibrinated blood are not identical with adenosinphosphoric acid of the muscle, because the latter does not lose its effect when boiled, while the former loses its toxicity when heated to 59 C. He further found that in contradistinction to the juice of a fresh muscle, that obtained from an electrocoagulated muscle did not cause death when injected into the ear vein of a rabbit. It is possible that the rapidly working toxins affect the lesser circulation and the splanchnic area first and the central nervous system secondarily. Electrocoagulation destroys the toxicity of the rapidly working tox-

ins because it generates a temperature of from 60 to 80 degrees, whereas their activity is inhibited at 59 degrees of heat. The autolysates of expressed muscle juice when injected into the ear vein of a rabbit caused death in smaller doses than that of the rapidly working toxins. The author found that autolysates from an electrocoagulated muscle were less toxic. Comparative studies of growth of bacteria (*Staphylococcus pyogenes-aureus*) on raw, boiled and electrocoagulated muscle showed that they grew more slowly and in smaller numbers on the electrocoagulated muscle. The author believes that he demonstrated in experiments that electrosurgical trauma produces little reaction on the part of the nervous and circulatory systems. — J. A. M. A. (July 14) 1934.

Infrared Photography of Subcutaneous Veins.

Brit. J. Dermat. and Syph., 45:506, (Dec.) 1933.

Haxthausen emphasizes the fact that by infrared photography it is possible to demonstrate varicose changes in the small and medium-sized subcutaneous veins that can be recognized but indistinctly—or not at all—by direct observation or by ordinary photography. This type of varix is found in some cases together with varices of the larger veins, while in other cases it constitutes the only form of varix present. In the latter cases, including several of ulcer and eczema of the leg, the foregoing venous changes represent presumably an important part of the condition that heretofore has been designated as "concealed" varices. — J. A. M. A., 102:12-969, (March 24) 1934.

Methods of Producing Hyperpyrexia by Various Physical Agents. J. R. Merriman, and S. L. Osborne.

Ill. M. J., 64:237, (Sept.) 1933.

Twenty-five treatments were given by means of diathermy using the technic of Neymann and Osborne. This method from the standpoint of the patient's comfort is the method of choice. Undoubtedly this comfort has a physiological basis because the heating is more internal and not at the expense of the delicate nervous mechanism of the skin as in the case of external applications where the internal heating is produced by conduction.

Patients with excessive adipose tissue do not tolerate diathermy well, but this difficulty can be overcome by using the cuff method.

Our cabinet is made in two sections and placed on the bed over the patient. The authors used sixteen 60-watt incandescent lamps mounted in the cabinet twenty-one inches from the patient's mattress as their cabinet bath. This was thermally insulated by blankets. The current is usually turned off when a rectal temperature of 105 degrees F. is reached. Temperatures by this method are obtained about as quickly as with diathermy. An occasional fat patient seemed to

be more comfortable in the cabinet, but the majority had a preference for diathermy. Twenty-nine treatments were given with the electric light cabinet.

Artificial fever may also be produced by hot water baths, using a water temperature of 110 degrees F. The patient's rectal temperature rises to 105 to 106 degrees F. in fifteen to forty minutes. When the patient's temperature reaches the desired level, usually 106 degrees F., he is placed in the heat insulating treatment bag. To maintain this temperature the treatment bag must be preheated to prevent a decrease in the patient's temperature on placing him therein. For this purpose we employ three electric heating pads. Thus for the first time we have been able to maintain temperatures of 105 degrees F. or more for from four to eight hours by this method.

Electric blankets for production of fever were found to be a dangerous and hazardous procedure. This is the most uncomfortable, slowest and exhausting treatment so far used. Fourteen treatments were given by means of the electric blanket.

Four treatments were given in the infrared cabinet but this proved to be very unsatisfactory and was finally discontinued as too dangerous. The patient's temperature fluctuated up and down all through the treatment.

Electrocardiographic Changes During Brief Attacks of Angina Pectoris. M. K. Gray.

Brit. M. J., 1:847, (May 12) 1934.

Gray presents four cases of angina pectoris having a brief attack in the consulting room. The attacks were probably induced by excitement, as there was no preceding exertion, and were relieved by rest, the longest time for complete cessation of pain having been twenty minutes. Definite changes in the ventricular complexes of the electrocardiograms were demonstrated. These changes resembled those produced by coronary thrombosis. They are not always present, owing no doubt to "silent areas" in the myocardium, changes that do not affect the electrocardiogram. The author states that the positive evidence adduced in the foregoing cases and in those previously reported points toward the coronary origin of anginal pain.

Progress in Otolaryngology. Acute and Chronic Otitis Media. Samuel J. Kopetzky.

Arch. Otolaryng., 3:344, (Sept.) 1933.

Zinc ionization is by far the most popular measure reported during the last year. Lacaille used it in 9 cases with good results in only 3. On the other hand, Ashereon observed a cure in 240 cases, or 95 per cent of those in which he used it. He thoroughly cleanses the ear first. He selects only cases of central perforations, with no polyps, and there must be no cholesteatoma present. Lierle and Sage used the zinc ionization method after a radical mastoidectomy

which failed to result in a healed ear. These authors made experimental studies of the zinc ionization process to determine how it produces its effects. They contend that there is a remote possibility of a deposit of zinc in living tissue. The question cannot be considered as settled because the observers based their reports on spectroscopic findings rather than studies of tissues. They report that the electric current used has little if any anti-bacterial value. They imply that the good results obtained are the result of a deposit of zinc sulphate in the tissues. Walker, who reports generally favorable results, advises that if good results are not obtained by the second treatment, there is no use in persisting with this method. He applies the treatment to ears which have a large perforation, an open eustachian tube and no necrosis of bone. He reports cure in about 59 per cent of cases.

Reynolds restricts the use of this method of therapy to early cases. Among 36 cases, he obtained cure in 55 per cent and improvement in 42 per cent. In 3 per cent there were no results.

The Treatment of Tuberculosis of the Larynx. **R. Scott Stevenson.**

Brit. M. J., 3803:960, (Nov. 25) 1933.

Tuberculosis of the larynx is never primary, and its treatment must be founded upon the conception that it is always secondary to tuberculosis of the lung. It is the patient who must be treated and not the larynx, and any improvement in the larynx will progress with the improvement in the lung. It is of little use to cure the larynx and have the patient die of his lung disease. Hence, the extreme surgical treatment of tuberculosis of the larynx, advocated by a former generation, has been abandoned, and such methods of treatment as artificial pneumothorax and phrenic avulsion are in the ascendant.

The importance of preventive measures must not be forgotten. Every patient suffering from pulmonary tuberculosis or suspected to be, should have the larynx examined regularly, as a routine. A clear breathing through the nose, proper use of the voice, restraint of noisy coughing, all tend to inhibit the development of tuberculosis of the larynx. Any infection of the nose or throat should be adequately treated; a simple alkaline nasal douche to clear the catarrhal or purulent discharges from the nasal passages has often helped the improvement in affected patients, and has no doubt helped to prevent infection of the larynx in others. Drainage of infected maxillary sinuses is beneficial, as also careful removal of septic tonsils. Alcohol and tobacco should be prohibited or, if tobacco be allowed, greatly restricted. Edson and others are advocates of climatic treatment, and believe that the patient with tuberculosis of the larynx has an advantage in high

altitudes. It is, however, difficult to assess the various methods of treatment in vogue.

The mainstays of treatment have been general sanatorium regime and vocal rest, supplemented by artificial pneumothorax. When one tries to come to a conclusion about any method of treatment, whether it be artificial pneumothorax, ultraviolet light, sanocrysin, or another, we have to remember that all patients were also being treated by the sanatorium regime, many of them by local or physical rest, and all of them constantly under the eyes of keen medical officers.

Detachment of the Retina — Its Present Operative Treatment. Dohrmann K. Pischel.

Am. J. Ophthal., Series 12:1091, (Dec.) 1933.

The author describes the operative technic of several men. Weve uses a very fine diathermy needle, and perforates after very careful localization with his own instrument. Operating with a current of 60-80 ma. he holds the needle in place, after perforation, for about three seconds. He then inspects the fundus and re-perforates if he finds he did not exactly strike the tear or hole.

Vogt uses a galvanocautery, but cauterizes for 10 to 20 seconds, actually boiling the vitreous.

To wall off a portion of the retina, Safar uses the diathermy current to achieve an exudative choroiditis in place of the actual cautery of Gonin, or the KOH stick of Lindner and Guist. But like Lindner and Guist he attempts to make a wall of exudative choroiditis which will act as a bassier to prevent the spread of the detachment.

The advantages of this operation are: First, the retina is safely protected from trauma by being held away from contact with the pins as they are inserted. There is thus no possibility of tearing, burning or cauterizing the retina itself, which might lead to new degenerating areas with new holes. Secondly, as drainage takes place through many fine openings, the retina can settle back gently into its proper place, without strain or traction. Furthermore, any part of the globe can be reached by the brush electrode. Besides these advantages, all those of the Lindner-Guist operation, such as treatment of one or several holes, or of a tear, or of sectors, hold good as well. Additional points are that the technic is not difficult, nor is it time consuming, as the placing of the individual pins is merely a matter of seconds.

The accidents and disadvantages of this operation are chiefly theoretical. If sufficiently high frequencies are used, there are no such dangers. It is necessary, however, to use current high and long enough to get a choroidal reaction. The current should flow one or two seconds after the pin is entirely in place through the sclera.

CANCER OF THE HEAD AND NECK *

A Critical Analysis of Available Therapeutic Methods

FRANCIS L. LEDERER, M.D.

CHICAGO

"Is cancer curable?" This question is a challenge to the medical profession, in spite of the fact that some of its constituents have answered in the affirmative. A critical analysis of available therapeutic measures makes it doubly difficult to answer the propounded question. Information from an exhaustive literature, with its new and modified instruments, radical suggestions for operative procedures, and last, but not least, theories of the origin of cancer, bring but little solace to those looking for the positive answers to the query, "What is the treatment of malignant growths?" Fortunately from a regional point of view, we are concerned with accessible pathology. The method of attack and the response are subjects to be discussed in greater detail.

To understand the problem at hand is to know the historical, statistical, biophysical, biochemical, pathological and clinical aspects of cancer. These particular phases of the subject present a mass of conflicting opinions, not always based on good judgment or reasoning. Closer perusal of this material clearly demonstrates the tendency toward *post hoc ergo propter hoc* conclusions, waves of enthusiasm for certain therapeutic measures (revivals of the older methods being very common), the preaching of radicalism and the practice of conservatism, and preliminary reports which are never confirmed or denied later. It is not advisable to be too dogmatic, not have our ideas too individualistic, nor formulate any habits; we must be able to adjust ourselves to prevailing conditions and adhere to facts. While seeking the basic cause of cancer, which after all must be our objective, we must of necessity work for a more effective treatment of the disease in order to check its horrible ravages and save more lives.

Some General Reflections on Cancer

Incidence and Death Rate. Statistical data has for many years occupied those who have been interested in the general question of cancer. The local problem that concerns our special field lacks authentic detail toward which we have suggested a simple procedure. Cancer is reportable to the city health authorities only when it results in death, and even then statements of regional distribution are not required. For the past three years the detailed international list of causes of death has been revised, being more specific regarding the site of the tumor mass. Detailed statistics for cancer under nine main and thirty sub-headings are now available in Chicago. Inasmuch as such reports are not compulsory (cancer not being considered a communicable disease), it will be quite some time before dependable statistics as to the frequency and site of cancer are available. Clinical material in the determination of heredity as a factor is of uncertain value, particularly since the average layman's antecedent history cannot be considered authoritative. An operation or an autopsy can prove the presence of malignancy and only such material can be of value in vital statistics, which at the present time are so highly speculative.

Irrespective of the uncertainty of statistics of the regional or anatomical distribution of cancer, general statistics are of interest. According to the statistics of a large life insurance company, the death rate from all types of cancer climbed from seventy-seven to eighty-three per hundred thousand in 1931, the greatest advance ever made in a single year. It was, therefore, estimated that the total cancer deaths in the United States for 1931 were about 100,000, and that three or four times that number are afflicted with some stage of the disease. It is believed that at the present rate, the deaths will double in a dozen years. In Chicago the cancer deaths in 1900 numbered 986 per 10,000. Since then the population of the city has doubled. The

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* Read at the Thirteenth Annual Session of the American Congress of Physical Therapy, Philadelphia, September 13, 1934.

4,066 cancer deaths of 1933 indicate a gradual but marked increase. A rate of 106.5 in 1929 to 117.0 per 100,000 population in 1934 (first five months) is sufficiently alarming to call these statistics forcibly to our attention.*

On the assumption that cancer is a disease of civilization, it has been suggested that the apparent increase is due to a rapid influx of populations to the larger cities. This reason appears unsound for outdoor life and the general health are of no influence in the production of cancer. Carcinoma has been noted frequently in farmers hardened by labor, who had retired a few years previously in apparently good health and had settled down to a life of ease⁽¹⁾. Nevertheless, the results of animal experimentation are borne out in that a decidedly low cancer rate has been noted in persons who are of necessity physically active. There exists doubt in some minds as to whether any actual increase in prevalence has occurred, for comparative statistics contain a number of sources of error (accuracy and interpretation of figures) which seem to nullify the importance of any such vital statistics. With the increase in the length of life of the average person, a larger part of the population is now attaining the age at which there is a marked susceptibility to cancer. Comparative statistics are also related to the improvements in the diagnostic methods which are now available.

The incidence of cancer in age groups is somewhat altered when classed according to the location of the tumor. For example, in a study of 457 cases of laryngeal carcinoma, the figures of which represents the usual experience, the age groups were distributed as follows:⁽²⁾

20-30 years....	5 cases or	1.1 per cent.
30-40 years....	41 cases or	9.0 per cent.
40-50 years....	121 cases or	26.5 per cent.
50-60 years....	188 cases of	41.1 per cent.
60-70 years....	80 cases or	17.5 per cent.
70-80 years....	17 cases or	3.7 per cent.
80-90 years....	5 cases or	1.1 per cent.

While cancer is apparently, and has always been considered in the past, to be a disease of old age, the percentage of cases of laryngeal malignancy under 40 (approximately 10

per cent) is so great as to place the physician on guard so far as the age factor is concerned. This fact is becoming more and more apparent to some of us who are in contact with a large number of cases of laryngeal cancer. Sir St. Clair Thomson estimates 100 out of every 1000 deaths are due to cancer, 1.8 per cent being due to laryngeal involvement.

Distribution

Site, Sex, Race and Habits. A statistical study does not reveal any immunity of race or sex, but the latter has an influence on the site of the growth, as is well known from a general survey of the cancer situation. In a study of 568 cases of carcinoma about the head, including the bronchus and esophagus, covering a ten-year period, at the Research and Educational Hospitals of the University of Illinois, we found that two and one-half times as many cases occurred in males as in females. Malignant growths of the buccal cavity were infrequent amongst the colored but not so infrequent in the nasal accessory sinuses. In a series of 250 malignant tumors about the head, analyzed by Boot⁽³⁾, 221 were in males, only 29 in females; 237 in whites and only 13 in the colored. The distribution as to site in our series of cases was:

Mouth and pharynx....	154 cases	27.1 per cent
Laryngeal	145 cases	25.5 per cent
Nose, nasal accessory sinuses and superior maxilla	97 cases	17.1 per cent
Bronchiogenic	79 cases	14.0 per cent
Esophageal	67 cases	11.7 per cent
Ear and mastoid.....	26 cases	4.6 per cent

The mortality statistics for carcinoma about the head must be qualified by stating the site and type of the growth. These factors are of importance in evaluating any report. MacKenty⁽⁴⁾, a few years ago, estimated that approximately 80 per cent of the cases of laryngeal cancer, which he had observed, were intrinsic in type and therefore operable. One may be certain that institutional cases do not offer such a high percentage of favorable types as these. The cancer patients seeking institutional aid are mostly of two classes; first, those whose lack of intellect has allowed the lesion to progress beyond a cure, and second, those who sought aid early from the inexperienced. In the patients of the latter class so much time has been wasted on conservative surgery and the temporizing application of radium and x-ray, that it is usually too late for

* A personal communication from Dr. Herman N. Bundesen, President of the Chicago Board of Health, dated June 28, 1934. His tabulations show:

Year	Number	Rate per 100,000 Population
1929	3544	106.5
1930	3897	114.9
1931	3870	111.9
1932	3904	110.8
1933	4066	113.0
1934 (5 mos.)	1748	117.0

radical measures. The blame falls on the physician who fails in making an early diagnosis of cancer and also in pointing out the correct course to follow.

The site of the tumor is often a factor in preventing early recognition, and thus becomes an important factor in statistical considerations. As was stated, we are perhaps fortunate that most areas with which we deal are accessible to inspection, but there are some exceptions which do present problems. For example, pyriform sinus and sinus Morgagni carcinoma may exist for a very long time before giving rise to annoying, visible, or urgent symptoms. True subglottic cancers are likewise difficult to diagnose, as they may not present symptoms until invading considerable of the edge of the cord. While site unquestionably is a factor in preventing early recognition of cancer, at the same time the cry of early diagnosis must of necessity be qualified by a few remarks. Surely, we have all observed cases with metastatic glands, the patients having experienced some difficulty or discomfort only for a few weeks. It would seem that pain causes an individual to seek aid, and inasmuch as pain is not an early symptom, a process can progress to the point of hopelessness without manifesting itself in major proportions.

From year to year progress is reported in the search of the cause of cancer along hereditary, biologic, infectious and chemical lines. The one etiological factor that does not seem to be disputed is that long continued irritation and inflammation are predisposing factors. Jackson,⁽⁵⁾ in analyzing hundreds of cases of laryngeal cancer, found vocal abuse definitely a factor. Tapia⁽⁶⁾, on the other hand, has never seen laryngeal cancer in singers, his feeling being that they are especially careful of their throats and seldom smoke. Irrespective of the cause, a constant laryngeal irritation is a potentially precancerous condition in a person in the so-called cancer age, and we may say, "that means anyone under sixty!"

It is a noteworthy fact that in practically no instance of carcinoma in the larynx or about the mouth have we observed even a fair state of dental hygiene. In all our patients with oral or laryngeal cancer the teeth were in a definitely bad condition. This was true even in the better class of patients. Sources of infection about the mouth act admittedly as irritants, and rough, tartar-bearing, carious teeth produce irritation by mechanical action.

Boot, from his analysis of malignancy about the head, concluded that occupation, heredity, alcohol, syphilis and social state have little or nothing to do with the genesis of cancer. Tobacco and filthy mouth seem to be the chief agents in starting the tumor and in determining its site. Smoking habits, in relationship to cancer of the buccal cavity, esophagus, larynx and lungs, was carefully noted by Hoffman⁽⁷⁾, in an extended statistical study. In Tyrol, where smoking among women is common, the incidence of laryngeal carcinoma in that sex is great. I have seen four women with laryngeal carcinoma, none of whom had ever smoked. One of these used her voice professionally and was but 43 years of age. While many believe that such factors as bad teeth, alcohol, tobacco and syphilis are potent influences in the causation of intraoral cancer, the fact remains that cancer also occurs when such factors are absent. There appears to be no direct relation between the pathology of carcinoma and the biological action of such processes.

Anatomical Considerations

It is impossible to discuss malignancy generally without making an evaluation upon the basis of the region involved. The same cellular invader may respond in an entirely different manner in the various parts of the body. Entering into this consideration is the type of tissue, skin or mucous membrane, cartilage or bone; the possible interference with function and the proximity of the tumor site to vital structures. The normal vascularity and lymphatic distribution of the parts are likewise of practical importance. I have already mentioned the importance of site and accessibility of the areas under discussion, for recognition and therapeutics.

Primary carcinomas of the middle ear are of great interest, probably because of their rarity. These do not include the many cases of epithelioma of the external ear or canal, which secondarily may involve the middle ear. The cartilage of the auricle is remarkably resistant to malignant invasion, but its equal lack of vulnerability to irradiation takes such an involvement out of the class of conservative consideration. Five cases of suspicious granulations arising from the middle ear following a chronic suppurative otitis media, were found on biopsy to be due to malignant changes. The analogy between cholesteatoma and carcinoma of the middle ear (Fisher)

appeals to me on the basis of comparative forces activating each and the heteropathy characterizing both histologic pictures.

The *larynx* is an anatomical part which lends itself to a more distinct case grouping for prognosis. This is mainly on the basis of lymphatic drainage, so that when a tumor mass is on or below the true cords, it is classed as *intrinsic*, whereas, a tumor anywhere above this level, as for example on the false cords, the arytenoids, aryepiglottic folds, pyriform sinus (most frequent site in malignancy of the hypopharynx), is classed as *extrinsic*. There are some who classify these growths in a different manner, placing all those involvements of the true cords, subglottic area, ventricles, as well as the ventricular bands and interarytenoid area (the latter are really *borderline intrinsic*), in the intrinsic class. That such a division is erroneous is borne out by anatomic evidence. The regions above the true cords are not as well protected by cartilaginous barriers nor by such a sparse lymphatic distribution to limit extension, as exists at the level of the true cords. Again, the subepithelial structures of the true cord are more firmly bound down than they are in the regions above this level. The intrinsic types drain into the not so richly supplied peritracheal glands. These do not readily manifest themselves, in contradistinction to the extrinsic areas which drain into the rich lymphatics of the neck, metastasizing early and readily. It has been shown histologically by New and Fletcher that the extension of laryngeal cancer beyond its apparent margin varies considerably with the type of cellular activity. The more immature types tend to penetrate deeper and involve the lymphatic distribution more readily. Therefore, it must be borne in mind that macroscopic interpretations of localization and extent differ from the microscopic evidence of invasion. It is the latter that materially affects the entire outcome of the case. Our observations of laryngeal cancer have been to us an incredulous nightmare because less than 2 per cent of cases have been intrinsic and, therefore, operable! It would be difficult to fix the blame for this distressing experience. A more favorable series, and perhaps an average one, is a group of 95 cases reported by Alonso and Regules⁽¹⁰⁾ in which 42 were intrinsic, 25 borderline intrinsic (early extrinsic and without glands), 20 extrinsic and 8 were undetermined. Perhaps in times of economic stress the clinics

can look for a greater number of operable cases because patients will be forced to consult such sources directly, and, consequently, early.

In the symptomatology of *malignant growths of the sinuses* there has been little to aid us in judging the extent of involvement. Moreover, contrary to the generally accepted view, very few of our cases had ever had sinus disease prior to the insidious onset of the nasal blockage, epistaxis and headache, which they complain of when first seen. It is notable that the majority of these patients have had recent turbinectomies or submucous operations performed to relieve the nasal obstruction. Of course, after the tumor develops and destroys the normal contour of the nasal cavity, the marked facial deformity leaves very little to the imagination in considering a diagnosis. It is of importance to bear in mind when patients present themselves with nasal polyps in such abundance that they protrude from the nares and even cause external deformity. Often biopsies from such cases are reported as benign in character. Biopsies are not always authoritative, however, and should be repeated if there is the least suspicion of malignancy. Most important in the study of sinus tumors is a determination of their extent. Even when seen early, encroachment on the bones of the skull may be more extensive than the clinical examination reveals. The growth of ethmoidal and orbital cancer is slow, metastasizing infrequently. There is a definite tendency of such tumors to invade the meninges and other intracranial structures.

The *tumors of the pharynx* are best considered in relation to the anatomic location because of the special histology and functional interference of the parts. *Epipharyngeal Tumors*. Growths situated on the posterior pharyngeal wall, the roof of the nasopharynx or the lateral walls in the region of the tubal orifices are included in this group. They may occur at any time in life, the early symptoms being nasal blockage, a feeling of continuous head colds or a foreign body sensation, hemorrhagic secretion or repeated hemorrhages, cough, disturbance of speech (rhinolalia clausa) and hearing, headaches, neuralgias and oftentimes cervical adenopathy. The symptomatology divides itself into groups, viz: respiratory, auricular, neuralgic, ocular, systemic and metastatic. Many neurological symptoms and symptom-com-

plexes may occur, such as, unilateral amaurosis, ophthalmoplegia, trigeminal neuralgia, involvement of the glossopharyngeus, vagus and accessorius (*jugular foramen syndrome*). Pressure of a large mass in the tubal orifice and on the velum palati, may result in difficulty in hearing, trigeminal neuralgia (second division) and asymmetry of the two arches of the palate (*Trotter's triad*). Such tumors have been known to penetrate into the orbit, resulting in a unilateral exophthalmos.

Mesopharyngeal Tumors. In this region the tumors involving the tonsils, soft palate, valleculae and base of the tongue must be considered. The more anaplastic forms of carcinoma usually involve these areas, with a tendency for early metastases, particularly in the glands of the carotid triangle. Difficulty in swallowing, a foreign body sensation, expectoration of mucus, and an itching or burning may be the cardinal complaints. The carcinomata in these areas have a great tendency for infiltrating the surrounding tissues and toward ulceration. The *hypopharyngeal tumors* are those which arise from the epiglottis, pyriform sinuses, the arytenoids, aryepiglottic folds and the postcricoid area. While these areas are anatomically parts of the larynx they are for clinical purposes considered to be a part of the pharynx.

A word about *bronchiogenic and lung cancer* including endobronchial, peribronchial and parenchymal, is not amiss, inasmuch as the laryngologist, in the role of the bronchoscopist, is seeing them more and more. Our statistics have shown a tremendous rise which some regard as probably relative⁽⁸⁾. What has caused this sudden increase is open to much question; our mode of living, dust and combustion gases and the increase in smoking may be factors. Improved knowledge and armamentarium also has led to better recognition of such lung pathology. On my service at the Municipal Tuberculosis Sanitarium, I am seeing a great number of carcinomas of the lung in association with pulmonary tuberculosis and in individuals who have had previous pleural or bronchial affections, these conditions oftentimes masking the presence of the malignant growths⁽⁹⁾. Physical signs are variable, but it is of interest to the laryngologist that a number of cases in my series presented themselves with laryngeal symptoms due to a paralysis of the recurrent laryngeal nerve. The bronchoscopic findings of compression or distortion, or of pulling over to one side of the

trachea, indicated in these patients, the possible presence of a tumor mass in the upper lobes; spreading of the carina (bifurcation) due to compression of one of the main bronchi and that the tumor was situated in the mediastinum. In most instances we are rewarded with neoplastic evidence in the bronchial lumen which may be removed for biopsy, or, at times, sufficient material can be aspirated to give positive cellular evidence of malignancy.

Multiple malignant tumors of a primary nature are, in contrast to multiple benign tumors, comparatively rare⁽¹¹⁾. Statistically, the number varies from 0.04 per cent to 0.76 per cent although recently observers record them as high as 2.7 per cent⁽¹²⁾. Such primary multiple tumors may be divided into several groups (1) those which are found in the same system as, for example, the digestive tract, (2) those which in organs have a physiological relationship, such as the ovaries, uterus and breast, and (3) the tumors which appear in organs not having any relationship to one another. Those which fall into the first group, especially with reference to the tongue and esophagus or pharynx and esophagus, have occurred in our experience 9 times while those which fall into the last group, 12 times. In this group they not only have fulfilled the requirements of having a different localization, a different histological structure, but also their own metastases (*Billroth's postulates*). The latter group comprised such combinations as middle ear (squamous cell) and stomach (adenocarcinoma), external ear (basal cell) and sinuses (squamous cell), base of tongue and face, external nose and rectum, external nose (epithelioma) and buccal mucosa, and the larynx and skin of both hands (following trauma).

Clinical Index of Malignancy

There is no stereotyped manner of judging malignancy. Too many factors enter into the evaluation of malignant disease to subject it to any such didactic plan which would serve no real purpose. The consideration must always be an individual one, embodying the fundamental principles of anatomical localization, the response of the body to tumor invasion and the cellular activity of the neoplasm. These being the main premises by which we logically consider our problem, they readily form the basis for our thoughts. I have diagrammatically indicated the manner in which



Fig. 1. Schematic representation of the bases for rationalizing indications for therapy in cancer. The triad of therapy, viz., surgery, irradiation and electro-surgery, singly or in combination is indicated with a consideration of all these factors.

malignant growths may be considered (Fig. 1).

It is of value to have a definite plan for grading tumors as to their cellular activity and effect upon the human organism. We join with others in emphasizing what is called "a clinical index of malignancy" on the basis of location, reaction (which implies the duration and rate of growth and the extent of the local as well as the general manifestations of the disease), type of tumor (as studied histologically), the age of the individual, and whether or not the patient has had previous treatment. The treatment, as well as the prognosis, is dependent on a number of these well known factors, viz., the degree of malignancy, the type of neoplasm, presence or absence of lymph node involvement and metastasis, fixation of the growth, anatomic relation and location, renal and cardiac efficiency, the general condition of the patient, the presence or absence of anemia, the size of the growth, the age of the host, the duration of the disease, the direction of the growth, the presence or absence of loss of weight, the presence or absence of cellular differentiation, lymphocytic infiltration, fibrosis and hyalinization, and finally, the extent of the destruction by previous therapy. In the final analysis, these points

coincide with the practical clinical experience in the treatment of malignant tumors.

We have, in the past, placed great dependence on the plan of Broders⁽¹³⁾, in grading the tumors on the basis of the cellular activity as studied histologically. These gradings are presented in direct proportion to the proliferative, infiltrative, metastasizing and death-dealing properties of a given tumor. In many instances, however, we have found these criteria not to be absolutely true, as determined by the further progress of the patients, and from careful follow-up records. Rieman⁽¹⁴⁾, found that the prognosis corresponded to the histological grading in but 5 per cent of cases. It would seem, therefore, that the other factors in the clinical index (metastasizing quality and extension to vital structures) are more dependable and must be considered collectively, especially when trying to determine the prognosis. According to MacCarty⁽¹⁵⁾, the length of life is in inverse proportion to the amount of glandular involvement and distant metastasis. From a practical standpoint there is no clinical difference between group 2 and group 3 (transitional cell and lymphoepithelioma). Both are malignant and both kill the host. The only differences of the three types are the his-

tologic pictures and the usual greater malignancy of group 3.

The tendency on the part of pathologists and clinicians to reach an accord in the classification of tumors and their clinical significance is by no means universal. There is in some quarters a tendency to view the problem as being of very little scientific importance. Nevertheless a close and cooperative study of the microscopic character of a tumor, together with the observation of its clinical behavior, is logically the method of attack. We may thus be in a position to judge the further course of a case and determine the proper therapy.

Tissue for Biopsy. It might be well to consider at this time the removal of tissue for diagnosis. There exist too many personal equations in regard to this, some clinicians advising against biopsy, and others taking tissue and not regarding any time element between this procedure and operative interference. My personal reaction is that both err decidedly. Animal experimentation seems to prove that massage or manipulation induces metastasis of tumor cells, but clinical experience does not absolutely verify this point. While, unquestionably, we should first take the clinical picture of a case into consideration, it seems illogical and a great responsibility to subject an individual to therapy or operation without first ascertaining the true nature of the growth. It is a sad commentary to perform a radical surgical procedure or institute any therapy, only to discover that the growth is benign.

I have operated upon many cases in which tissue for biopsy had been removed a long time prior to the operation, without any apparent metastasizing effect. The fear of spreading malignancy by removal of tissue for biopsy has oftentimes led to the extreme of depending solely upon that not altogether reliable clinical picture. Some clinicians insist upon biopsy, with the understanding that if the findings are positive, the patient is immediately prepared for surgery or for other indicated therapy. If, therefore, we choose to adopt a principle, this appears to be a sound one.

There are cases on record in which the diagnosis of cancer was rendered difficult because of natural factors. The tumor made up of benign and malignant elements as well, but with the malignant tissue quite deeply situated and inaccessible to the usual methods, is an interesting and important possibility. The

classical case of Kaiser Friedrich III, who died at the age of 56 of carcinoma of the larynx, but who was thought to have a benign lesion because of the study of tissue removed at biopsy, is to be always borne in mind when clinically a growth appears malignant and proves to be histologically benign. In his case a benign lesion was superimposed upon the malignant area. Such experiences have led laryngologists to believe that biopsy cannot be regarded as indicating more than the status of the tissue at the exact point from which the specimen was taken. Since biopsy is still the most reliable means of diagnosis, particularly in laryngeal lesions, the procedure can be repeated, going deeper for the specimen or taking it from another location. Sufficient tissue should be removed and the block examined serially. Lesions which are small may be completely removed at the time biopsy is performed.

There have been interesting neoplastic formations both etiologically and in combination with other diseases. We have observed numerous cases where, for example, epitheliomas have developed from paraffinomas. An interesting observation is the frequency of osteogenic sarcoma associated with Paget's disease with perhaps the latter as the predisposing factor. Carcinoma engrafted upon a lupus has occurred twice in our series. While referred to as lupus-carcinoma, we were of the opinion that the intensive local therapy of the lupus precipitated the malignant growth. Recently, with my associates, I⁽¹⁶⁾ reported a case in which a rapidly growing anaplastic type of carcinoma originating in the nares gave rise to retropharyngeal and cervical metastases. Secondary infection resulted in a virulent septicemia which produced a plasmocellular response of the infiltrating tissues. Histologically, such a plasma cell granuloma shows a dense plasma cell infiltration or proliferation, a marked and frequently a bizarre response of the reticular cells and more or less of an eosinophilic response.

Treatment

There is a great disadvantage in developing therapeutic agents and applying them long before all factors are known about them. This type of progress is slow and uncertain, forming the substance of the unscientific and pessimistic literature of former years. It is quite natural that in the attempt to combat a disease as terrifying as cancer, many meth-

ods in confusing array be presented. Some are employed empirically, while a very few seem to have a definite basis for their use.

A summary of the non-surgical measures which have been employed in the last 20 years in the treatment of cancer is listed below. This summary points out the heterogeneity of methods.

Non-Surgical Methods in the Treatment of Malignancy

I. Bacteriotherapy.

1. Bacterial products.

II. Autoserotherapy and Organotherapy.

1. Autolytic solutions (tumor extracts or specific globulins or proteins). Jensen sarcoma triturate; Coley's toxin.
2. Proteins (non-specific).
3. Autohemotherapy.
4. Vaccines.
5. Serous exudates.
6. Tissue extracts.
Cartilage, muscle, hematopoietic tissue, (bone-marrow, blood, thymus and spleen), liver, pancreas, embryonal and placental tissue.
7. Physiological or endocrine therapy.
(Pituitary, thyroid and parathyroid, suprarenals and gonads).

III. Vitaminotherapy.

IV. Chemotherapy.

1. Escharotics externally.
 - (a) Arsenic paste.
 - (b) Arsenic-mercury paste.
 - (c) Chromic acid.
 - (d) Trichloroacetic acid.
 - (e) Butyric acid.
2. Arsenicals internally.
 - (a) Salvarsan.
 - (b) Atoxyl (arsenic and anilin.)
3. Elements (colloidal).
 - (a) Copper.
 - (b) Magnesium.
 - (c) Zinc.
 - (d) Iron.
 - (e) Lead.
 - (f) Antimony.
 - (g) Potassium.
 - (h) Arsenic.
 - (i) Calcium.
 - (j) Silver.
 - (k) Bismuth.
 - (l) Uranium.
 - (m) Platinum.
 - (n) Silicon.
 - (o) Gold.
 - (p) Strontium.
 - (q) Mercury.
 - (r) Thorium.
 - (s) Selenium.

4. Emanations and Radioactive substances.

- (a) Solutions.
Alphacatalyst.
Choline.

5. Dyes.

- (a) Trypan red.
- (b) Trypan blue.
- (c) Trypaflavine.
- (d) Congo red.
- (e) Eosinate of selenium.
- (f) Methylene blue.
- (g) Scheele green.
- (h) Pyrrol blue.
- (i) Isamine blue.

6. Acid therapy.

Hydrochloric acid, oxygen and nitrous oxide.

7. Carbon dioxide snow.

V. Physical methods.

1. Irradiation.

- (a) X-ray.
 1. Skin therapy (50,000 to 100,000 volts).
 2. Superficial therapy (50,000 to 140,000 volts).
 3. Deep therapy (200,000 volts).
 4. Super therapy (500,000 to 1,000,000 volts).

(b) Radium.

1. The element.
 - (a) Capsules, superficial collar application.
 - (b) Needles — Intratumor or interstitial implantation.
 - (c) Superficial contact or surface application.
2. The emanations.
 - (a) Radon seeds; interstitial implantation.
3. The pack or bomb—Telradium application.

2. Electrosurgery (Surgical diathermy).

- (a) Cutting current:
(Biterminal and monoterminial high frequency current). Obtained from the primary winding of the high frequency transformer.
- (b) Electrodesiccation: (including fulguration).
(Monoterminial high frequency current). From the secondary winding of the high frequency.
- (c) Electrocoagulation:
(Biterminal and monoterminial high frequency current).

It is well that we free ourselves from the hopeless prognostic teachings of former years. That would, of course, add to the prevalent inertia of the profession in attacking the cancer problem. I would discourage any attempt to inculcate the type of vicarious stimulation such as is employed in discussing the problem with the layman. This attitude would be a serious one to impress upon the profession, which already has adopted the extremes of the aforementioned passive hopelessness and allowed themselves to assume the indifferent, if not self-satisfied feeling of finality in progress.

In reviewing the treatment of carcinoma, it is well to speak of the non-surgical methods. In passing, bacteriotherapy, autoserotherapy, chemotherapy, vitaminotherapy, and physiological or endocrine therapy should be mentioned for one frequently encounters reference to these procedures all of which have been found wanting.

Apparently, the various substances used act as foreign proteins. There is evidence, from histologic study of certain cases of cancer, that the body tissues react against such an invasion in much the same way as against any foreign body in their midst; viz., by an active leukocytic infiltration with the subsequent changes that have been noted in normal tissue. Histologically, the reaction has been likened by some observers to an immunologic reaction. Clinically, such non-specific sera have brought about temporary arrest of the growth of the mass and cessation of pain. Some advise the use of the elements, dyes, sera, etc., simultaneously with irradiation. In our particular field, however, cancer has not responded to such agents. Nor have the results with chemical pastes warranted a continuation of such therapy.

Irradiation (X-Ray and Radium)

We must remain open minded regarding radiation therapy until more is known concerning its properties and technical application. Naturally the etiology of cancer falls in line as an important related factor. X-ray and radium, singly and combined, in the light of our present knowledge, must be recognized as of value. These agents formerly were employed only in late cases, with no definite technic. As a consequence of such indifferent usage, the results were far from satisfactory and caused considerable skepticism among doctors and patients. Our present conviction is that x-ray and radium have a definite place in the treatment of cancer, and that, furthermore, in many instances, they remain the method of choice in the hands of those familiar with the physics and applications of these rays⁽¹⁷⁾. The practice of renting and selling radium and emanations to physicians, qualified as they may be in the general, or even in the special practice of medicine, should be discouraged as proper irradiation therapy requires far more skill, care and specialized knowledge than is possessed by the average physician or surgeon who has access to their use⁽¹⁷⁾. Many unfortunate accidents and lack of success in

the past may be charged against such a practice. There is an ever increasing tendency to standardize the technic in the same ratio as the diagnostic effort. Naturally, the spirit of cooperation between the interested specialties has been responsible for the strides which have been made. While this progress in the last ten years has shaken off much of the empiricism which characterized its use, much work remains to determine dosage, intensity, etc., for improved results. In the meantime, as Coutard states, the cure by x-rays, for example, is still difficult and dangerous.

Histological types, methods of extension and the local factors determine the choice of radium or x-ray for irradiation. It is a fact that x-ray and radium exert a selective action on the malignant cell, and, we know further, that the time of the division of a cell is the time of its greatest radiosensitivity⁽¹⁸⁾. Therapy must be individualized in every case, and, inasmuch as there are no two cases alike, accuracy in diagnosis both as to the extent of the tumor and the type of its cells, must be diligently sought. It is well to remember that cancer is a different disease in each organ; we recognize not only a difference in the site of the tumor, but also a difference between the tissues of the same organ and between the cell types in the same tissue, and, finally, as was mentioned before in discussing the grading of tumors, there is a difference in the radiosensitiveness of the cellular species⁽¹⁹⁾. As this subject has received greater impetus during the past few years, it has resulted in more far reaching achievements in radiology.

From the experience of some authors, the tumors of the pharynx (nasopharynx, oropharynx and hypopharynx) are often more radiosensitive than their histologic counterparts of the adjacent oral cavity, intrinsic larynx or esophagus⁽²⁰⁾. This quality, it seems, is common to all pharyngeal tumors and is not a special characteristic of such well known histologic varieties as lymphoepithelioma and transitional cell carcinoma, which are also most commonly found in the pharynx. Many believe, therefore, that this radiosensitive phenomenon cannot be explained on the basis of the histologic structure, and that the degree of malignancy has nothing to do with the sensitivity to radium⁽²¹⁾. However, some radiologists consider squamous cell carcinoma (Fig. 2), transitional cell carcinoma (Fig. 3), and

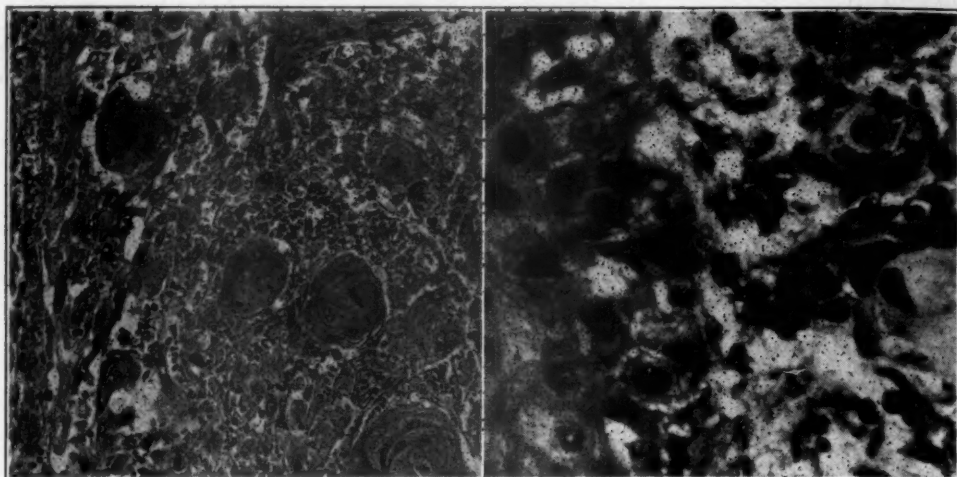


Fig. 2. *Squamous cell carcinoma.* Such a tumor, characteristically, has such qualities as hornification, epithelial pearls, adult type, metastasizes late and is radioresistant. The cells for the most part have differentiated to the point where reproduction has been reduced to a minimum. Epitheliomas, epidermoides, plattenepithel, Grade I and II (Broder), are synonyms which have been applied to this type of tumor by pathologists the world over.

lymphoepitheliomas (Fig. 4) as the standard of response.

Berven⁽²²⁾, finds the histologic classifications of the Germans, French and Americans rather confusing and adopts the simple divisions of

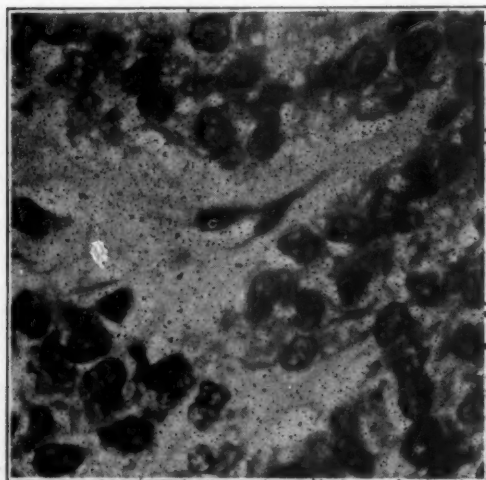


Fig. 3. *Transitional cell carcinoma.* The adult character of this type is characteristically absent; small, round and polyhedral cells with hyperchromatic nuclei growing in cords and sheets (Cutler) are present. The cells are undifferentiated. Non-epidermoides, unreife tumor, Grade III or IV (Broder), are synonyms which have been used at various times to describe this type.

carcinoma, lymphoepithelioma, sarcoma (lymphosarcoma) and malignant mixed tumors. What is important, is that Berven does not grade his cases of carcinoma histologically as to malignancy or radiosensitivity but classes them into the groups on the basis of the absence of palpable metastases, those with

movable glands and those with inoperable metastases.

The mitotic cells are the most sensitive but have the least accumulative power. For comparison, we might take the moist seed, which can be killed with smaller doses than the dry seed, but the dose must be given at one time. For the inactive cell larger doses are required, but they may be given in fractional or divided doses accomplishing the same purpose as the massive doses. This has a definite clinical application to the question we have before us and has been the basis for the most constructive work in irradiation.

In selecting cases for irradiation, the general status of the patient must be given careful consideration. The variability of site and the difference in radiosensitivity between the different varieties often make the determination of therapeutic indications difficult. This therapy should not be used on cachectic, anemic, debilitated individuals with diabetes, nephritis, myocarditis or those with distant metastases. The blood picture should be checked at frequent intervals to see if it shows any deleterious effect from the treatment. It is very often necessary to be content with the palliative irradiation treatment because of late diagnosis and evidences of spread and metastases with which these patients so often present themselves. Nevertheless, I would rather have a patient with a stationary or slowly progressing carcinoma than a dying one whose cancer has been killed by the rays. In addition to the widespread necrosis that may be

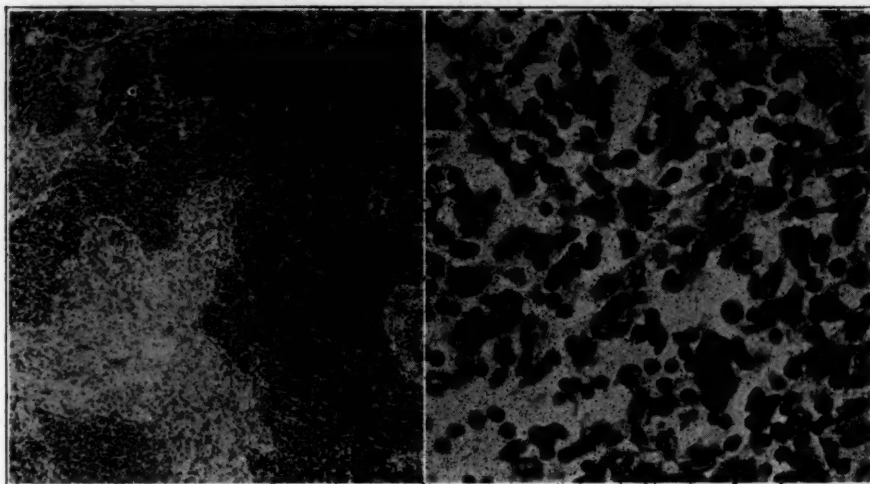


Fig. 4. *Lymphoepithelioma*. This form of neoplasm is characterized by clumps of lymphocytes in a highly undifferentiated state; the cell elements are anaplastic but decidedly malignant. There is a net-like syncytium of epithelial cells with lymphocytes in the retiform spaces. The nuclei are large, pale and vary greatly in size. Nucleoli are present and mitotic figures are plentiful. In the low power, the density of the lymphocytic infiltration may be noted. Regaud and Schminke tumor is given as the name of this form by a number of pathologists. The very radiosensitive features of this form are definitely characteristic.

caused by irradiation, and, this, of course, must be considered a bad sequel, the toxemia or roentgen intoxication is at times a difficult condition to combat, being so severe as to cause death.

We have always recommended daily treatment with moderate dosage as being more effectual and less damaging to the general condition of the patient. Despite the fact that the dosage can be mathematically calculated, the treatment must be individualized. The knowledge of the dosage has advanced to a degree where it can be more readily calculated and the biological reactions are thereby more easily controlled. The *protracted fractional dosage* with low intensities of Coutard is to be commended. Coutard⁽²³⁾ delivers his daily dosage of roentgen radiation over a period of 15-25 days or longer, so that the total deep radiation is 3,500 *r*, which reaches the depth of the tumor. Other technics vary the dosage upward of 9,000 *r*; during a period of 2 to 4 weeks, 6 to 60 hours, and at a distance varying from 30 to 80 cm. The radium is used twice a day, over a period of two or three weeks, a single dose with a 4 to 6 gram bomb is administered for 1 to 2 hours at a time. The reaction of the skin is not in form of a burn, but an "epidermite," the skin surface peels and becomes moist, taking a considerable time to heal. Pfahler⁽²⁴⁾ uses radium in doses of 40,000 to 60,000 mgm. hours, with a filtration equivalent of 4 mm. lead and an air gap of 4 to 5 cm. The radium, in the form of in-

terstitial application, may be used in accessible areas of residual carcinoma.

From the study of histological preparations of irradiated tissues, Ewing⁽²⁵⁾ came to the conclusion that the effect of roentgen irradiation is more pronounced on connective tissue, while radium seems able to act more selectively on the cellular structures. We find cell differentiation again coming into the therapeutic application, for we know that the basal cell carcinoma is more sensitive to x-ray than is the squamous cell type, and that lymphosarcoma is more sensitive than the other types of sarcoma. Prickle cell types, for example, showing a distinct senescence practically show no response. These growths may exist for years without very active growth. One might, therefore, suppose that they (x-ray and radium) would work best in combination. Furthermore it is not unlikely that a tumor should contain radiosensitive as well as radioresistant areas.

Attention has been called to the removal of the lipid content of the cell by the x-ray; this, indeed, seems to constitute its chief function in the destruction of the cancer cell⁽²⁶⁾. Lipoids are essential to the growth of the cancer cell; hence the importance of affecting not only the cell but also the stroma, so as to cut off any source of supply of this lipid substance. Some workers in cancer research, do not believe that there is a constant relationship between the degree of malignancy and the number of mitoses seen in the tissue. It

is a fact that mitotic figures may be entirely lacking. Parkhurst, in a study of one hundred epitheliomas, found that the number of plasma cells, and, to a somewhat lesser extent, the number of lymphocytes, varied directly with the amount of hyaline degeneration. As the number of plasma cells is an indication of the degree of resistance (*immunity*) of the tissue (*derma*), the malignancy of the neoplasm varies inversely in proportion to the number of plasma cells. The more malignant the process, the less the number of plasma cells, the scarcity of which shows that the neoplasm is developing so rapidly that the tissue has not had the time to develop any resistance. This is considered by many to be a note of prognostic value.

If irradiation has a place, then certainly the preoperative application of the rays to regions of likely lymphatic extension is indicated. This we have for years felt to be a very definite aid, but there are several objections to the practice, one being that such treatment requires a period of two weeks, and, if it is not to interfere with wound healing, a further period of at least a few days must elapse before operation. This, of course, means that the surgical treatment is delayed. The purpose of preoperative irradiation is to devitalize outlying cancer cells as well as those within the zone, so as to prevent extension and implantation during the operation; the idea being to treat the disease while it is still microscopic.

While we found irradiation to be of value, it had, early in our experience, proved far from ideal and wholly insufficient as a cure because of improper technic. We were well aware of the fact that the results of x-ray and radium therapy reported in the literature had been, in many instances, so encouraging that the end-results of surgery could not be compared with them. The earlier failures of clinicians, and even some of the present ones, are not so much the fault of the method as its technic of application. Nevertheless, while it is true that radiological methods of dealing with malignant lesions about the head seem to be gaining in favor, I cannot help feeling from past experiences that they can be regarded as adjuncts to our surgical methods in some cases, while in others they are to be entirely depended on. Moreover, as I have already stated, cancer must still be considered as a disease, not a geometric equation, and, as such, it is subject to the individual variations. For this very reason there is some difficulty indi-

cating what measures should be employed. While absolute rules and principles do not exist in dealing with this phase of the cancer problem, I am attempting to present those methods which have proven successful in competent hands.

The most reliable forms of treatment, in fact, the only ones thus far justified by experience, depend upon surgery, x-rays, radium and electrosurgery. We should make use of all these measures properly selected, singly or in combination, rather than rely on one to the exclusion of the other. Each one has certain attributes in which the others are deficient. Whatever method one prefers, it is best not to become attached to it fanatically, but to select now the one, then the other, or a combination of methods, according to the basic principles of evaluation of histologic character, the clinical index and location, which have been proposed. It is as unjustifiable to treat an operable carcinoma by x-rays or radium alone as it is to indicate surgical measures in extensive involvement with metastasis. In making these statements, I give full consideration to the percentage of cures reported in lip, pharyngeal, lingual and laryngeal carcinoma from treatment by radiation alone. To us, the fact that some cases may be successfully treated by non-surgical measures and others again by surgical methods would seem ample proof that a selective and a combined method of attack by these weapons, judiciously employed, would serve the best interests of the case at hand. Our attitude, therefore, should not be that of pitting one method against another, but rather that of attempting to coordinate their action in some cases selecting one method such as surgery, or radiation in others. It would be better were we to have a definite plan of placing indications rather than of applying these methods hit or miss. (Figure 5.) This should not be accepted as a formula but indicates the methods in order of application which have given the best results.

Surgery has not, in the past at least, been used in cases in which extensive metastases were present. These have been subjected to x-ray and radium with varying results, but at least a percentage of cures has been realized. For the majority of intra-oral carcinomas, such as cancer of the tongue, cheek, floor of the mouth and tonsil, radium and x-ray have this in their favor as the method of choice, that the results of surgical removal alone have not warranted continuing with surgery as a

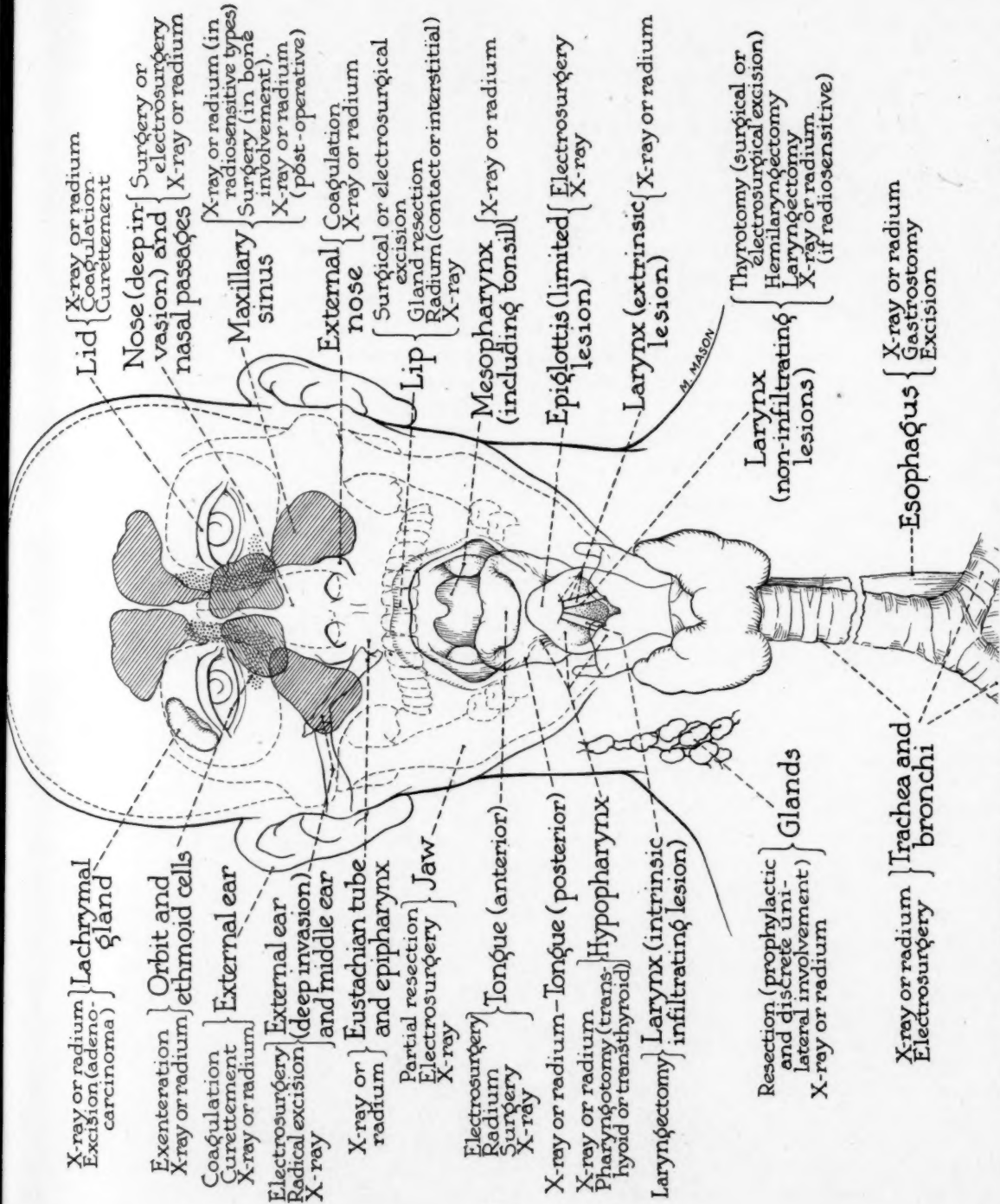


Fig. 5. Regional distribution of cancer, showing the most logical modes of attack in the various locations, in order of their proven value. Some may be used singly, others in sequence or in combination, depending, of course, upon the type of cellular activity, depth of involvement and character of the tissue invaded.

single method of treatment. As a matter of fact, the literature discloses no more brilliant achievement in radium and x-ray therapy than that recorded for mouth cancer⁽²⁷⁾. Certainly, as far as accessibility is concerned, mouth cancer in many instances lends itself well to the implantation of radio-active emanations. Some objection to interstitial irradiation has been made because of the risk of dissemination. The radium treatment should be combined with roentgen irradiation of the portals of lymphatic distribution. In addition, in some cases, we employ a collar of Columbia paste or of dental stent containing the element, to the neck, giving an "epidermicidal dose"; and the radium pack, a special apparatus, containing 4 or more gms. of the element. The present mode of the use of such massive irradiation dosage producing the "radioepidermitis" (skin) and the "radioepithelitis" (mucous membrane), according to the protracted fractional technic, is most effective.

We do not share the prevailing optimism regarding the use of radium in buccal, meso-, hypo- and epipharyngeal carcinoma, (the cheeks, floor of the mouth, nasopharynx, soft palate, base of tongue and the tonsils). As a rule radium will eradicate the local lesion but the patient succumbs nevertheless of metastases or extension of the tumor to vital structures. Such involvements have given poor results with radium and x-ray, singly or in combination. When combined with endothermic excision and the dissection *en bloc* of all gland bearing areas better results have been noted. An improved technic of irradiation promises a more favorable outlook in these cases. In our experience, the nodes in the neck have always been viewed as inoperable. We are in accord with some of the prevailing opinions regarding the limited field of usefulness of neck dissection, especially in bilateral involvement.

(This article will be concluded in the October issue of the ARCHIVES.)

THERMOSTATICALLY CONTROLLED HEATING HOOD IN VASCULAR DISEASES OF THE LOWER EXTREMITIES *

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About three years ago I had the opportunity of treating several cases of thrombo angiitis obliterans by means of hyperpyrexia induced by short-wave radiation. Some of these cases responded well, others did poorly. Their feet became more deeply cyanotic and pain developed during treatment. This variation in results was confusing until the work of Landis was called to my attention. Landis⁽¹⁾ showed that the capillary pressure is raised to a considerable degree by an elevation in the temperature of the tissues. Thus while in the skin of the finger he obtained, under normal room conditions a pressure of about 32 mm. Hg. in the arteriolar limb of capillary loops and about 12 mm. in the venous limb, he found these values raised to 60 mm. and 45 mm. (107.6 degrees F.). Since the osmotic pressure of the plasma proteins in man is

about 26 mm. Hg., this implies a filtration pressure of edema formation equal to the difference, or some 25 to 30 mm. of Hg. Presumably this fluid would drain away through the lymphatic system, under normal conditions.

Of interest also is the work of Goldschmidt and Light⁽²⁾ who showed that the venosity of venous blood returning from a limb depends upon the balance between the metabolism and the rate of the blood flow. Both of these are increased by a rise in temperature. The changes are not parallel. At high temperatures the rate of circulation was increased so greatly that the venous blood contained large amounts of oxygen even though the metabolism was undoubtedly much increased. Bazett and Sribyatta⁽³⁾ demonstrated that when the temperature is elevated not only is there a change in the oxygen saturation of venous blood, but physico-chemical factors are brought into play which considerably modify gas ten-

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 15, 1933.

sions by liberating the dissociation of oxyhemoglobin and by modifying the acid-base balance and blood pH.

These physiological investigations indicated that while the application of heat produces a vasodilatation and, therefore, an increase of the collateral blood bed when the normal vascular channels have become partially or completely occluded as a result of disease, it is possible to aggravate the diseased condition by the application of too much heat. Depending upon the degree of pathologic involvement in a given case there is an optimum amount of heat which can be applied.

In 1931 Starr⁽⁴⁾ indicated this to be his experience in the clinical care of individuals suffering from vascular disease of the lower extremities. He determined this optimum temperature by placing the involved extremities in a large water bath equipped with a stirring device and a heating unit. He found that this optimum temperature usually was at the level of about 34 or 35 degrees C. At this temperature elevation the cyanosed feet approached the most normal color and the pain became lessened. He heated these patients by placing them in bed and covering their legs with a foot cradle containing heating elements and equipped with a thermostat to maintain the temperature inside of the cradle at the previously determined optimum temperature level. The cradle was kept in operation constantly for 24 hours a day. Subsequently Starr⁽⁵⁾ added oxygen to the air in the cradle. The concentration of this gas reached a level of 80 per cent. He used this additional procedure in the treatment of gangrene. He also added calcium chloride placed in pans within the cradle to keep the air dry to cause a dehydration of the gangrenous part.

Thermostatically Controlled Heating

We have used the thermostatically controlled heating hood with very satisfactory results in the treatment of vascular diseases of the lower extremities. Our cases included both those of thrombo-angiitis-obliterans and of arteriosclerosis. A review of some of the cases which we have treated will serve to indicate the results which we have observed.

CASE 1.—A man, 60 years of age, who had been suffering with a deficiency of the circulation of his lower extremities due to arteriosclerotic changes presented himself with one leg amputated below the knee. The remaining foot was minus all the toes, and had a large ulcer on the under

surface. This ulcer had been present for several months in spite of all efforts to cause it to heal. The use of the thermostatically controlled heating hood was applied particularly during his sleep. This result was a gradual improvement with complete closure of the ulcer. The continued use of this device during the past year has kept him free from pain and able to attend to his usual activities.

CASE 2.—Another case of arteriosclerosis was that of a man, 70 years of age, who (for several months) after suffering from cramps in the muscle of his calf following slight exertion, began to show marked cyanosis of the toes of his right foot while lying in bed. The middle toe presented evidence of beginning gangrene. Continuous use of the thermostatically controlled heating hood improved his condition, so that he was able to be up and attend to his business. He subsequently died of a cerebral accident secondary to the arteriosclerotic involvement of the vessels of his brain.

CASE 3.—A man, 64 years of age, had evidenced signs of intermittent claudication during the past seven years. His condition was diagnosed as that of arteriosclerosis. During the preceding year and a half, he had been treated by means of intravenous saline solutions and diathermy. He had also discontinued smoking. After two months use of the thermo-regulated cradle which he applied only during his sleeping hours, he stated that his progress had been much greater than it had been during the past year and a half of strenuous intravenous and diathermy therapy. Walking the length of one short city block had been the limit of his exertion before he had to stop because of the pains in his legs. At the end of two months of this treatment he was able to walk 12 blocks without difficulty.

CASE 4.—The rapid relief from pain which the use of this device may afford is sufficient to warrant its application even where the extent of the general arteriosclerotic involvement may totally incapacitate the patient. This is illustrated in a case of a man 82 years of age, whose last three months of existence were made much more comfortable because of the relief of pain which he experienced following the use of this hood.

CASE 5.—A case of thrombo-angiitis-obliterans was that of a man 53 years of age, born in Russia, who presented himself in December, 1932, complaining of pain in the calves of his legs on walking a short distance. This condition had persisted for three months. He was smoking about twenty cigarettes daily. No pulsations were felt in his dorsalis pedis nor in his posterior tibial arteries. Both feet felt cold and appeared cyanotic. The Pachon oscillometer failed to reveal any pulsations. Diathermy treatment administered during a period of about a month caused a very slight improvement in his condition. Shortly after the additional nightly use of the thermostatic heating hood he became able to walk a distance of several blocks before he was forced to stop. He has continued the use of this hood during the past eight months. He is now able to walk a distance of about two miles. The Pachon instrument reveals oscillations in both feet, the ex-

cursions of the needle covering 1 to 2 of the subdivisions. Throughout his treatment he has persisted in the use of his usual amount of tobacco.

Factors Regulating Controlled Heat

Of interest because of its reference to the therapeutic value of this procedure as well as its description of a simplified hood, are some excerpts of a letter sent to me by J. E. Malcomson, Lieutenant Commander in charge of the Physical Therapy Department at the U. S. Naval Hospital in Brooklyn, New York. He writes:

"I had such a short time to prepare these cases that I was unable to procure thermostatic devices for my foot cradle, so I was obliged to attack the problem of exact heat regulation from another angle. It occurred to me that this could be done by means of bulbs of graduated wattage, so I took one of our foot cradles of a type which is merely a frame with a convex reflector at the top, having a capacity of about 20 cubic feet. To give you a standard from which to work, I will relate the procedure which I followed to attain a temperature of 90 degrees F. Within this foot cradle I put four 10-watt bulbs and I insulated the inside of the cradle from the outer air by merely putting a standard Navy blanket over it. With the room temperature at 80 degrees and the barometer at 30-33, this gave me a temperature within the cradle of 90 degrees F. With this as a point from which to start I was able by the addition or subtraction of a variable number of 5 and 10 watt bulbs to regulate the temperature to any degree which I wished.

"There are a number of factors to be considered in regulating heat this way if one wished to use an inexpensive frame for a foot cradle. For instance, at night when windows are open and the room cools off, it will be necessary to add one or more blankets to increase the thickness of the insulation and to add one or two more 10-watt bulbs. However, the method is susceptible of being worked out to give the patient a temperature of exactitude.

"It will interest you, from the physician's standpoint, to know that the three patients which I have, require different temperatures for the relief of their pain. One keeps his foot cradle at 90 degrees F., the second at 96 degrees F., and the third man keeps his foot cradle between 92 and 94 degrees F. The advantages which this method seems to have over the method of regulating heat by a thermostat are:

"First, it is cheaper — one uses much less current and there is not the original cost of the thermostats.

"Second, the method is foolproof, because there is no highly sensitive mechanism to get out of order, and unless the bulbs break or the current is turned off, the heat remains constant.

"Third, it gives a constant temperature and the work of Starr shows that it was maintenance of proper temperature over a long period of time

rather than a thermal reaction due to change of temperature, which gave relief.

"Fourth, there is a beneficial psychic effect on the patient — this apparatus gives him a plaything. Any intelligent patient can take this apparatus and work out his own salvation by a little experimentation if his salvation is a question of thermic relief of pain.

"Again, I want to thank you most kindly for your help in loaning me your gear and also for the many references which you furnished me of work along this line. My great satisfaction comes from walking into the ward and having these three men, who were unable to sleep because of the pain in their legs, tell me how comfortable they are and how grateful they are for their release from pain."

While it is possible to improvise a hood such as Dr. Malcomson describes it is very satisfactory to employ a more positively thermostatically regulated instrument. At first we used a thermostat of the variety employed for the heating control of houses. We are now using a much simpler bimetallic thermostat. Each one of the four carbon filament lamps within the hood is individually controlled. The purpose of this is to avoid any marked differences in the temperature of the air contained in different parts of the enclosure. This defect could also be avoided by the use of a small fan. Such a device might be noisy and would also introduce the factor of more active air motion. We have therefore not employed it.

Conclusions

The use of the thermostatically controlled heating hood is an important addition to the various procedures which may be utilized in the treatment of vascular diseases of the extremities.

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OBLITERATION OF HEMORRHOIDS WITH NEGATIVE GALVANISM *

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Hemorrhoids being affections most frequently seen by general practitioners, a method of treatment which in selected cases is simple, free from risks, and ideally curative, merits earnest consideration. It is generally conceded that surgical removal of any kind has not been satisfactory in many instances, to say nothing of the need of anesthesia, hospitalization, after care, and the like.⁽¹⁾ It is partly due to these undesired methods of treatment and partly to the failure of the medical profession to avail themselves of simpler and less disabling methods that patients have been driven to seek so-called bloodless cures by irregular practitioners.

Unfortunately the medical curricula have adhered to the purely surgical aspect of therapy and have ignored certain advances which are not lacking in scientific rationale. Drueck⁽²⁾ states that occasionally even well executed surgical procedures have resulted in such complications as hepatic abscess, rectal stricture, infections, and recurrences due to jeopardizing systemic conditions. There are, of course, certain forms of hemorrhoids for which surgery of some sort is absolutely indicated. But in the majority of instances I have found a method which is simple and yet highly effective. The patient's inalienable right to choose a less radical procedure is sufficient reason for inviting attention to the proper use of the negative galvanic current as an ideal method for obliteration of certain forms of hemorrhoids.

Rationale of the Negative Galvanic Method

Contrary to common belief, this method is not new,⁽³⁾ it being first employed in 1867. Nothing worthy of note was heard of it until 1892, when Baker presented a "Treatment of Hemorrhoids by Electricity." Baker's work inspired its adoption in certain localities, but many failures due to defective technic and unfamiliarity of its chemical action mitigated

against it. In the past decade successful technic has been developed. Chemical changes which take place in the tissues are now better understood. Although the exact colloidal reactions are yet to be discovered, research work leads me to believe that we are at the threshold of a thorough appreciation of the microchemical and physiological actions involved in the treatment. Sufficient experience has been gained to justify the classification of the obliteration of hemorrhoids by negative galvanism as a scientific method of treatment in the nature of a chemical reaction.

Haynes⁽⁴⁾ reports that in 1866, Althaus made microscopical observations of the changes in animal structures due to the electrolytic action of the negative galvanic needle. He found that the tissues were markedly contracted, and that there was neither inflammation, suppuration, nor sloughing. When the current was applied to the blood vessels they became changed into solid strings due to disintegration of the blood and deposition of lamellated fibrin. He concluded that no animal tissue can withstand the disintegrating effect of the negative pole; that the force and rapidity with which disintegration is brought about are directly proportional to the strength of current and to the softness and vascularity of the structures; and that the current could be safely and successfully applied to contract and disintegrate tissue, and obliterate blood vessels for surgical purposes. When applied to hemorrhoids, the negative pole produces first a hydrolytic decomposition and then a contraction of the tissues. Webb⁽⁵⁾ states that electrolytic destruction of the vasa vasorum is highly significant. Actual obliteration of the thrombosed mass is accomplished in one of two ways: It either absorbs as occurs in any simple contusion; or, if a large, thin walled hemorrhoid is treated, it ruptures, causing a discharge of the thrombosed elements into the rectum. Following this there is contraction of the underlying tissue with hemostasis, absence of pain, and rapid healing of the parts.

* Read at the Thirteenth Annual Session of the American Congress of Physical Therapy, Philadelphia, September 11, 1934.

* From the Physical Therapy Department, Cook County Hospital, Chicago.

Advantages of the Negative Galvanic Method

The advantages of this method are its simplicity, safety, and apparent permanency of cure. It is a procedure requiring neither anesthesia nor hospitalization. There are no unfavorable sequelae. In my own work I have never seen a severe complication in over 700 individual treatments. Actual hemorrhage has never been encountered, although patients commonly report the loss of a few drops of blood at stool following each galvanic application. To date there have been no cases of rectal stricture or metastatic abscess. Webb's experience with electrolysis justified his belief that there is no danger from embolism. The treatment presupposes special but simple technique.

Permanency of cure is due to complete obliteration of the entire vein from its point of origin to its most dependent portion. In surgical hemorrhoidectomy the actual site of origin of the hemorrhoid in the superior hemorrhoidal plexus is frequently too high to permit of surgical removal without an extensive operation with sacrifice of much normal tissue. If the terminal or dependent portion of the mass only is removed, the remaining segment near the plexus may easily become enlarged under pressure and cause recurrence.

Hemorrhoids may be classified as external, internal, and mixed or internoexternal. External hemorrhoids may be subclassified as thrombotic, skin tags, and varicosities. Internal hemorrhoids are subclassified as varicose, and capillary or nevoid piles. Internal varicose hemorrhoids are again subclassified into non-protruding and protruding. Mixed hemorrhoids possess the characteristics of both internal and external hemorrhoids.

As all forms of external hemorrhoids are covered with integument and richly endowed with sensory nerves, the negative galvanic current or any other method except surgery is not applicable. Their clinical significance does not usually necessitate special medical attention.

Internal and mixed hemorrhoids in one form or other make up 90 per cent of cases coming to treatment, because they are the most important clinically. It is in these types that negative galvanism is highly effective. True internal hemorrhoidal tissue being practically devoid of sensory nerves, obliteration

of these tumors with negative galvanism is a painless procedure.

Equipment

The principal appliances needed for this type of operation are:

1. A galvanic generator producing a perfectly smooth current.
2. A large, dispersive, indifferent electrode, 4x8 inches in size.
3. Large, medium, and small sized Brinkerhoff speculae.
4. A convenient operating table.
5. Specially constructed rectal needle electrodes with short, medium, and long tips.

The *active needle electrode* is a most important factor, because it must deliver the current to the interior of the hemorrhoid while preventing escape of hydrogen from the tissue, and allow clear visibility of the operative field. I devised in 1932, a set of electrodes so constructed as to prevent past defects in instrumentation. This set consists of a hard rubber handle with a six-foot cord, and three extra long, insulated, steel needles, with points one-eighth, one-fourth, and five-sixteenths inches in length. The insulated portion of each needle shaft is seven and three-fourths inches in length and only one-eighth inch in diameter, which permits ease of manipulation and affords clear vision of the operative field. As the exposure with a Brinkerhoff speculum is none too large, a needle shaft of the above dimensions is essential for unobstructed manipulation. The insulated portion is of hard rubber and is tapered at the base of the needle in a manner to prevent escape of hydrogen gas. A chuck in the needle handle steadies the needle securely, assuring perfect conductivity of the current.

The average case needs no other preoperative measure than evacuation of the bowels and a preparatory cleansing enema. A large, prolapsed, irreducible hemorrhoid may necessitate a preliminary divulsion of the sphincter. In cases of mixed hemorrhoids with external thrombi, the clots should first be emptied. It hardly needs mention that any etiologic factors responsible for the development of hemorrhoids should receive proper attention.

Technic for Internal Non-Protruding Hemorrhoids

The patient is placed on the table on his left side in Sims' position. The dispersive electrode, having been thoroughly moistened, is connected to the positive pole and placed un-

der the patient's left thigh. The needle in the insulated handle is connected to the negative pole. The speculum is gently inserted to its full length, well above Hilton's line, and the slide withdrawn until the uppermost hemorrhoid comes into view. Slight rotation of the speculum while the patient strains will expose the entire hemorrhoid. The needle electrode is now inserted into the tumor. As before stated, true hemorrhoidal tissue has no sensory nerves, which fact enables the painless insertion of the needle. Genuine hemorrhoid tissue is most often characterized by the brilliant red color of the submucous tissue appearing through a break or erosion in the mucous membrane, but if the mucous membrane is intact the tumor will have a dark violaceous appearance. The needle should be inserted wherever the bright red submucous tissue is observed. Normal mucous membrane is characterized by its pale, pink, translucent appearance and should never be touched with the electrode. The needle is inserted in the uppermost portion of the hemorrhoid, in the longitudinal axis of the vein, and at a very slight angle to the rectal canal. Insertion should be made firmly into the mass to prevent leakage of hydrogen, without, however, touching the opposite wall in order to avoid pain and possible sloughing of the muscularis or mucosa.

From the standpoint of pain and end results a successful treatment demands that the needle point be in the lumen of the vein. The patient is our best guide, for if he complains of burning pain the technic is improper. Anesthesia should be avoided in all cases, because it deprives us of this index. The current is now turned on very gradually, two to three minutes being required to bring the current up to 10 or 15 milliamperes, according to the tolerance of the patient. If in the opinion of the operator proper insertion has been made and there is burning pain, the needle point should be shifted to another angle while in the tissue. Should pain persist following such a manipulation, the current should be shut off and the needle reinserted into a new place. It should always be inserted before the current is turned on, and upon termination of treatment the current should always be slowly turned off before the electrode is withdrawn. A violation of these rules will produce a sudden shock, which, of course, should be avoided. The maximum current tolerance is con-

tinued until a change of color occurs in the tissue. At first, light colored bubbles are seen under the mucosa which later changes into a dark red, and in some instances nearly black, color. Treatment is terminated at this point, the whole procedure lasting 10 to 12 minutes. The current is slowly turned off and the needle withdrawn.

If the tumor is large, one or two other insertions are made one-fourth to one-half inches away from the first and the process is repeated. However, in all punctures subsequent to the first, the current is continued for only five minutes, because discoloration appears much sooner. The evidence of successful treatment is complete discoloration of the entire hemorrhoidal mass, the number of insertions required for each tumor depending on its size. Not more than one hemorrhoid is treated at a seance to avoid nervousness or fatigue of the patient. Treatments are given every third day, the average case requiring about six treatments for complete obliteration of all hemorrhoids.

Transitory nervousness and excitement may be controlled by general conversation during treatment. Complaint of burning pain is significant, but other sensations are due to pressure and require no attention.

Technic for Internal Protruding Hemorrhoids

Internal protruding hemorrhoids are treated while prolapsed, wherever possible, without the aid of a speculum. If the hemorrhoid cannot be reduced, a divulsion of the sphincter should first be attempted. Easily reduced hemorrhoids often do not protrude at a seance and should be forced out. For this purpose an enema may be given and the patient instructed to strain while evacuating. If this fails, the speculum should be inserted, the slide withdrawn, and the hemorrhoid crowded into the groove. The speculum is then withdrawn and the mass everted. Only the one hemorrhoid selected for treatment is everted and all others are replaced within the rectum to insure comfort. In this type of hemorrhoid a shorter needle in a 3-inch applicator is employed. The method of insertion, time of treatment, and current intensity are the same as in the preceding technic.

At termination of treatment the discolored mass is replaced within the rectum, no patient being allowed to leave the office without replacement of all protruding masses. Except

for a peculiar feeling of fullness for about twelve hours following treatment, there is no painful reaction. If a thorough treatment has been given the individual tumor will retract well within the rectum and carry the loose, redundant folds of perianal integument with it. This dramatic result never fails to impress the patient who has suffered with protruding hemorrhoids for a long period. After all protruding hemorrhoids have been obliterated, completion of treatment is exactly the same as that for internal, non-protruding hemorrhoids. The speculum is inserted and the remaining hemorrhoids treated at their origin, as high in the rectum as possible at first, and at lower levels later.

Capillary hemorrhoids are rare and clinically unimportant as compared with internal venous hemorrhoids. Being situated in the rectal ampulla, they do not protrude and are diagnosed by speculum examination. Due to their histologic structure the sentinel symptom is bleeding. Although they frequently heal spontaneously, they are effectively treated where indicated by insertion of the negative galvanic needle directly into the mass, with the same technic as for internal non-protruding hemorrhoids, but with a lessened current intensity and time.

Mixed Hemorrhoids can usually be successfully obliterated by applying the negative galvanic current to the mucous portion and treating through the speculum with the technic given for internal, non-protruding hemorrhoids. However, I wish to emphasize that the negative galvanic needle can never be applied to any hemorrhoid clothed with integument and therefore the external portion of a mixed hemorrhoid cannot be so treated. But in most cases, if the internal portion of the mass is obliterated, sufficient contraction takes place to cause a definite retraction of the external portion within the rectum where it undergoes contraction and obliteration.

Postoperative Treatment

Following each treatment, a small quantity of nupercaine ointment, 1 per cent, is injected into the rectum. No other postoperative treatment is necessary, as the after effects are negligible. Bleeding, pain, and protrusion usually cease after the first treatment; all symptoms are promptly relieved. The hemorrhoid undergoes a rapid change, the mucosa assuming a normal condition in one week to ten days. If the hemorrhoid is then not com-

pletely obliterated, insufficient current has been used. In such a case a second treatment of shorter duration should be given. At no time does the patient have to be recumbent.

Progress and termination of a case is determined by the speculum. Tumors readily force their way through the window at beginning of treatment, but when terminated the slide may be withdrawn to the papillary line and the instrument rotated in a complete circle without the usual bulging appearing in the window.

Existing complications are best treated preoperatively. Fissures, ulcers, perirectal abscesses, or fistulae should be eradicated first. A markedly contracted sphincter is divulsed before any treatment is given, because it will benefit small internal hemorrhoids and hasten the actual obliteration of the treated tumors. Proctitis and colitis commonly associated with hemorrhoids should not be treated first if they are a secondary manifestation.

Comparison With Operative Methods

The following comparative advantages of negative galvanism are enumerated:

1. Negative galvanic treatment never causes more than a well tolerated discomfort to the patient. Postoperative defecation is not painful. Surgical removal produces postoperative pain, usually severe enough to demand narcotics. Bowel movements during the seven-day postoperative period often cause severe pain.

2. Anesthesia is not required with negative galvanism, in contrast with surgery.

3. Hemorrhage following negative galvanism never occurs, while surgical removal, as emphasized by Drucek⁽⁶⁾, not infrequently is followed by extensive postoperative hemorrhage, requiring heroic measures for control.

4. Infection following negative galvanism, if ever, takes place⁽³⁾. The method itself is self-sterilizing. I have never seen an infection in a large number of cases treated both in private practice and at Cook County Hospital, Chicago. Infection following surgery is always possible and may become serious due to the venous relationship of the rectum to the portal system.

5. Sequelae and complications following negative galvanism have not been observed. Surgical removal frequently causes vesicospasm with retention of urine, stricture of the rectum with anal stenosis, fistulae, fissure, abscess, and incontinence of feces.

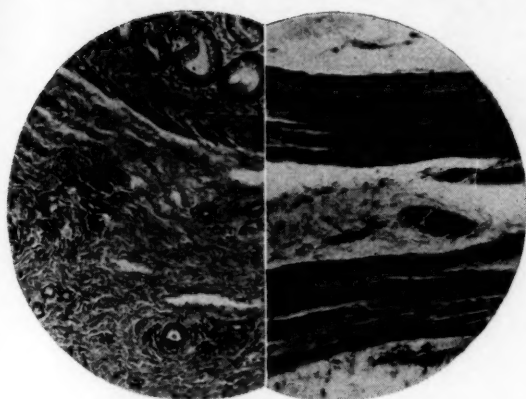


Fig. 1. Microphotograph (high magnification) of rectal tissue of dog taken 12 hours after treatment with negative galvanism at 15 ma. for 10 minutes. Note integrity of muscle fibers with complete destruction of connective tissue and vascular elements. Observe contrast with normal tissue section shown at left.

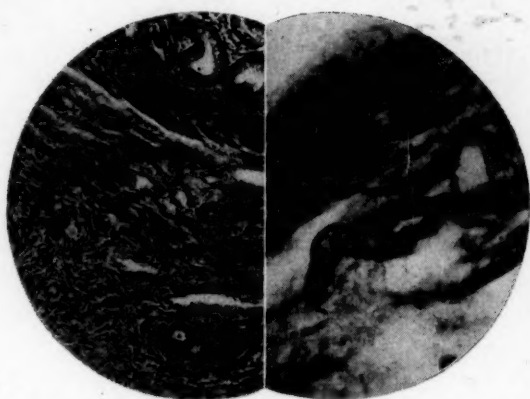


Fig. 2. Microphotograph (medium magnification) of rectal tissue of dog 12 hours after treatment with negative galvanism at 15 ma. for 10 minutes. Complete tissue disintegration is evidenced by absence of nuclei. Note thickening of thrombosed capillary wall and also of the intramuscular glands. The surface membrane presents a smooth appearance. Observe normal tissue section at left.

6. Mortality following negative galvanism has never been reported, while surgical fatalities from primary hemorrhage, fulminating infections, and bronchopneumonia, are matters of record.

7. Recurrence after negative galvanism must be very rare, not one having been observed in more than 100 cases. Webb⁽⁵⁾ found electrolysis of hemorrhoids to be the most permanent method. Permanency of cure is due to treatment of hemorrhoids at their origin. Miller⁽⁷⁾ states that a firm and normal physiological support for the venous plexus is formed by contraction and adhesion of the mucous membrane. Redundant mucosa becomes obliterated although normal mucous membrane retains its original elasticity and tonicity without scar tissue formation. With surgical methods, difficult accessibility to the hemorrhoidal origin in the plexus tends toward incomplete removal, and, even if the tumor is completely removed, there is usually a sacrifice of much normal tissue causing excessive scar formation and a potential stricture.

8. There is no loss of time to the patient with negative galvanism, it being an ambulant office procedure — a self-evident economic advantage. The same applies to avoidance of expense incident to hospitalization for surgery.

9. With negative galvanism there is no need for restriction of diet, before, during, or after treatment, usually required with surgical procedures.

Comparison With Electrosurgery

Electrocoagulation is an operative procedure

because of its destructive principle and need for anesthesia⁽⁸⁾. It has never been widely in vogue. Ronneaux⁽⁹⁾ states that when local anesthesia is employed there is danger of edema due to the action of the heat production on the excessive fluid of the tissues which causes undesirable postoperative pain and constant danger of hemorrhage. This procedure must be considered comparable to orthodox surgical removal with all its disadvantages. Although danger of metastatic abscess may be lessened as compared with classic surgery, this advantage is offset by the possibility of edema, painful postoperative reaction, sloughing, and hemorrhage. As compared with negative galvanism we must conclude therefore that electrocoagulation possesses most of the disadvantages of surgical hemorrhoidectomy.

Comparison With Injection Methods

The injection method presents such conflicting ideas regarding technic, solutions, dosage, and end results, that there is a lack of standardization. It therefore becomes difficult of comparison with either negative galvanism or operative methods. The rationale of the injection method is based on an inflammatory sclerosing reaction. Anderson⁽¹⁰⁾ observed microscopically that all changes following injection of 10 per cent phenol represented an effort of the tissues to repair an injury. By virtue of this action there is contraction of normal tissue and scar formation. Although hemorrhoids may be obliterated, this is done at the expense of a contracted, and distorted mucous membrane, which has lost its elasticity, and presents a hardened "washboardy" ap-

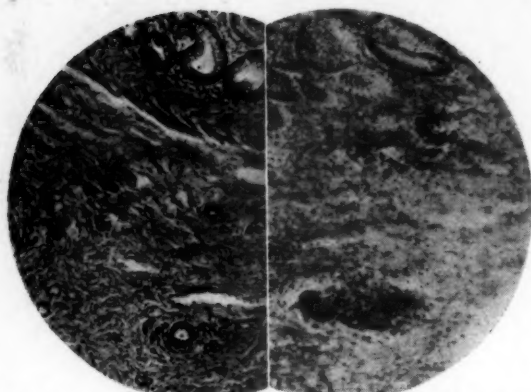


Fig. 3. Microphotograph (medium magnification) of rectal tissue of dog taken 12 hours after injection of $\frac{1}{2}$ c.c. of 5 per cent phenolized cells. Observe normal tissue section at left.

pearance. If insufficient solution is injected to produce this sclerosing effect, hemorrhoids fail to total obliteration. If not completely obliterated, they will return as they do following incomplete surgical removal. Thus, recurrence is not unusual and I have frequently treated cases successfully with negative galvanism which had been injected one or more times futilely. The negative galvanic current does not produce such an inflammatory sclerosing effect because the chemical action is on the liquid content of the mass instead of the tumor wall, and its one great advantage over all other methods is the resultant normal resiliency of the mucous membrane after obliteration.

Sequelae and complications following injection treatment are of frequent record. Spencer⁽¹¹⁾ reported a fatality and presented sufficient necropsy findings to justify his statement that injection of sclerosing fluids markedly reduces tissue resistance. Hawkins⁽¹²⁾ demonstrated the danger of infection and abscess formation from phenol injection and found that it frequently causes fistula. Kilbourne⁽¹³⁾ in 1934, made an exhaustive international survey of cases treated with operative and injection methods. Reports were obtained from 293 proctologists. Out of 26,262 cases treated with the injection method the following unfavorable results were reported: Severe sloughing, 285; serious hemorrhage, 73; severe stricture, 6. At the termination of a three-year observation period there were 966 recurrences in 9,691 cases injected. These results hardly differ from those reported by Andrews⁽¹⁴⁾ fifty years ago when the injection method was in its infancy. By comparison we find:

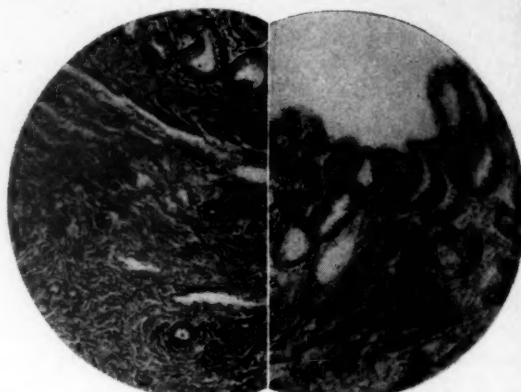


Fig. 4. Microphotograph (medium magnification) of rectal tissue of dog taken 12 hours after injection of $\frac{1}{2}$ c.c. of 5 per cent phenolized oil. Note marked sclerosis of muscularis mucosa, contraction of Goblet cells and marked contraction of surface membrane. Observe normal tissue section shown at left.

TABLE 1

Comparison of Past and Present Results of Hemorrhoid Injection

	ANDREWS	KILBOURNE
Severe sloughing	50 years ago, 1.06%	Today, 1.09%
Severe hemorrhage	50 years ago, .3%	Today, .27%
Anal stricture	50 years ago, .06%	Today, .02%
Recurrence	50 years ago, .5%	Today, 10.0%

That the ideal solution for hemorrhoid injection has not been found is attested by the fact that a well known proctologist who had used negative galvanism with highly successful results, is now attempting to produce hydrogen gas in the hemorrhoid by the injection of some chemical. It is obvious that he values the end results of negative galvanism above that of the injection method, but wishes to attain such results with the shorter technic of injection. In this endeavor I predict that he is doomed to failure, for I am certain that negative galvanism can never have a chemical substitute. Surely the splendid end results of negative galvanism will more than repay the operator for the few extra minutes of work. Dunne⁽¹⁵⁾ believes that treatment of the future for many rectal conditions will be some form of electrotherapy.

Limitations of Negative Galvanism

That external hemorrhoids cannot be treated with galvanism has already been stated. The comparative length of time required for each application has been the subject of objectionable comment. Complaint also has been made that due to the required time and exactness of technic, the procedure was too tedious for the operator steadily to support the needle. Another difficulty experienced by operators was their inability to change the setting of the generator while one hand was con-

fined to holding the speculum and the other the needle, requiring, therefore, the services of an assistant. I have overcome both of these features by devising a simple accessory, the "Needle Guide-Holder." It consists of a small knife-blade joint at the end of a one-half inch shank. This shank is inserted into a small split stud, fastened to the speculum by drilling a hole in the lower handle. Above the knife-blade joint and attached to it is a small sleeve with a ball-tension joint the calibre of which is large enough to accommodate the needle. In the center of the sleeve is an automatic spring which exerts a constant pressure on the insulated portion of the needle and prevents its retraction following insertion. At the right is a small screw lever. When this is loose the needle is capable of motion in any direction, but when tightened it holds the needle securely in place. It is then only necessary to hold the handle of the speculum with one hand, allowing freedom for the other to manipulate the generator. This device is removable and may be attached to any standard size Brinkerhoff speculum to which the necessary stud has been fastened. I have found it of great advantage in eliminating all tediousness and fatigue.

Report of Cases

A brief report of six typical cases is presented as illustration of what may be accomplished:

CASE 1.—Mr. R. R., aged 40, railway mail clerk. Symptoms: Bleeding, protrusion, pain, constipation. Protrusion constantly present; reducible but appearing again almost immediately. Pain of sufficient severity to cause absence from duty. Has taken epsom salts every morning for past two years. Was advised operation imperative.

Examination: A large internal protruding hemorrhoid is seen externally, deep red in color and about the size of a hazel nut. It is covered with mucous membrane and is reducible. Speculum examination reveals large internal hemorrhoids on all walls. When slide is withdrawn to the papillary line, the tumors protrude into the groove of the instrument at any point at which it is placed.

Diagnosis: Severe internal protruding hemorrhoids. **Treatment:** Eight applications of negative galvanism were given at three-day intervals.

Results: Bleeding stopped entirely after the first and protrusion ceased after the second treatment. Postoperative observation at three, six, and twelve months showed the hemorrhoids to have entirely disappeared as have all the subjective symptoms.

CASE 2.—Mrs. M. H., aged 48, housewife.

Symptoms: Constipation, backache, rectal pain, and occasional slight bleeding. Backache of three years duration. Has not been relieved by previous treatments.

Examination: Large internal hemorrhoids observed through the speculum. Externally no protrusion but a suggestion of bulging in perianal skin opposite both lateral walls.

Diagnosis: Internal non-protruding hemorrhoids.

Treatment: Six applications of negative galvanism at four-day intervals. Mineral oil nightly.

Results: Backache and rectal pain markedly relieved after the first treatment which gradually improved and disappeared after the fourth application. Bowel movements regular after the fifth treatment.

Comment: This case had been treated twice previously during a five-year period with the injection method. No recurrence either for the tumors or symptoms 22 months after completion of course.

CASE 3.—Mr. H. G., aged 53, newspaper editor. Symptoms: Slight bleeding after defecation. Occasional dull pain. Severe itching almost constant.

Examination: External, negative. Internally, moderately sized hemorrhoids.

Diagnosis: Pruritus ani, secondary to internal, non-protruding hemorrhoids.

Treatment: Six negative galvanic applications.

Results: Bleeding and pain ceased entirely after the second treatment. Itching improved after the first and disappeared after the third treatment.

Comment: This case had been operated twice and treated once with diathermy during a seven-year period, with incomplete relief.

CASE 4.—Mrs. N. E., aged 34, housewife. Symptoms: Constant pain, worse after defecation. Multiple peri-rectal abscesses for the past 3 years. Constant rectal discharge and occasional bleeding.

Examination: Connective tissue piles externally. No protrusion. Bilateral fistula-in-ano. Probe inserted to the depth of about one inch, but no internal opening was found. Multiple internal hemorrhoids visible through the speculum.

Diagnosis: Fistula-in-ano, internal, non-protruding hemorrhoids.

Treatment: Under general anesthesia, division of the sphincter and dissection of the fistulous tracts. This was followed in one month by four negative galvanic applications.

Result: Cure.

CASE 5.—Mr. R. J., aged 72, watchman. Symptoms: Protrusion with slight bleeding. Condition present for past 12 years, but bleeding has become less severe during past three years.

Examination: Large internal protruding hemorrhoids continuous with external varicose hemorrhoids.

Diagnosis: Mixed hemorrhoids, severe.

Treatment: Seven negative galvanic applications at four-day intervals.

Result: Protrusion of mucous portion disap-

peared after second treatment. External varicose portion markedly contracted after the fifth and disappeared after the seventh treatment. No bleeding after the second treatment.

Conclusions *

1. Treatment of hemorrhoids by negative galvanism offers a large field for qualified general practitioners. Ninety per cent of all hemorrhoids are amenable to such treatment.

2. Although surgical treatment is the only method for external hemorrhoids, all cases of internal and most cases of mixed hemorrhoids can be permanently and safely obliterated with negative galvanism, without loss of time and without painful reaction.

3. Negative galvanism is an effective and painless method of obliteration, the technic of which is comparatively simple. Many patients today demand ambulant treatment which should be accorded by ethical physicians.

5. The negative galvanic treatment of hemorrhoids is not new, but its technic has been greatly developed on a scientific basis.

6. The superiority of negative galvanism for internal and mixed hemorrhoids is based on simplicity of technic, safety of procedure, and permanency of cure.

7. Equipment embraces a generator which provides a smooth galvanic current and needle electrodes capable of flexible manipulation. A needle guide-holder saves labor and eliminates the need of assistance.

8. No special preoperative or postoperative treatment is required for this procedure.

9. Comparison of negative galvanism with other methods of treatment proves it the method of choice because of physiological end results and absence of serious complications.

10. Advantages of negative galvanism far outweigh its minor inconveniences, chief of which is the time involved for each of a series of successful applications.

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EFFECTS OF HYPERPERISTALSIS ON THE ELECTROCARDIOGRAM *

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This study first proposed to apply the electrographic method of registering the action current of the heart in connection with gastric peristalsis. It seemed plausible that the extreme hyperperistalsis present in congenital hypertrophic pyloric stenosis could be picked up by the electrocardiograph. Dissenting opinion, however, pointed out the slowness of peristalsis. While our first records were being obtained Alvarez and Mahoney succeeded in securing records in cats whose abdomen had been opened, and in one case of a feeble old woman suffering from gastric obstruction with signs of visible peristalsis. Thus records were obtained by direct gastric leads. They found that the electrogastrogram, as they termed it, resembled the tracing obtained with mechanical means, that the contractions were apparently of twenty-second rhythm as found by the mechanogram, and that the electrical wave seemed to arise from the mid-region of the stomach. These facts are interesting in the light of our own studies.

Results

First attempts by leads in the region of the cardiac and fundic ends proved disappointing. Indeed, objections to such results could easily be based on the very shift in position of the terminals with peristaltic movements. It was then decided to take another tack free from such disadvantages. Since slight skeletal muscular contractions produce artefacts in electrocardiograms, it was reasoned that severe contractions moving across the abdomen and readily visible should likewise produce some effect on the electrocardiogram. Attacking the problem from this angle, the author connected his galvanometer with lead III, and since positive results were obtained this procedure was followed in subsequent observation.⁽¹⁾

In congenital hypertrophic pyloric stenosis

with visible peristalsis, a wave-like undulation of twenty-second rhythm occurred in the base line synchronous with the wave. The time and form of the curve resembled the mechanogram as reported by Alvarez. Most interesting was the fact that the rise of base line did not begin until the wave was visible at about the mid-abdominal region. This was checked by observer to technician and vice versa, the observer seeing only the baby and technician only the galvanometer. This agrees again with Alvarez's observation on the exposed stomach. It appears that the action current develops optimally or maximally at this stage or cumulation of contraction wave.

Intestinal hyperperistalsis was recorded in two cases. Records from a child with congenital hypertrophic dilatation of the colon (Hirschsprung's disease) showed an irregular, uneven change in base line. An accidental record obtained from a man of 55 years with coronary disease, who happened to be connected to lead III, was introduced and showed marked irregularity in the base line associated with borborygmi.

Discussion

By the use of orthodox cardiac leads a constant is afforded deviation from which associated with peristaltic activity is indicative of peristaltic effect. In the gastric type of hyperperistalsis the picture is not surprising. A wave-like rise and fall indicates the passage of the action current along a definite axis. The gastric axis lies from above and left downward to the right, traversing a fairly definite path. The intestinal type represented in Hirschsprung's disease and borborygmi is expected to be vagrant because no definite one way direction is traversed. Rather there is motion pictured the changing algebraic sums of innumerable action currents of contraction waves preceded by dilatation waves occurring in different portions of a long hollow viscus simultaneously. Just as the typical cardiac complex is merely the moving picture of

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 13, 1933.

* From the Heart Station and the Sarah Morris Hospital for Children of the Michael Reese Hospital.

changing algebraic sums of action currents occurring in different parts of the cardiac musculature simultaneously, the hyperperistaltic effect is the resultant of these factors in the gastrointestinal peristalsis superimposed on the typical electrocardiogram.

Attempts have been made to obtain simultaneous mechanograms and electrograms. For many reasons unprofitable to discuss here there may be a dissociation in these two types of records.

From the standpoint of electrocardiographic study it was expected that these obvious effects were previously noted. However, nothing could be found in the literature in the nature of artefacts in the electrocardiogram due to peristaltic movement. Nevertheless, in the search through hospital records for the tracing of the borborygmi, many records with suggestive shifting of base lines were found. In Wenckebach and Winterberg's *Tafelband*⁽²⁾ a number of records are presented illustrating vagus effects with shifting base lines. Since the vagus is the activator nerve of peristalsis it is difficult to rule out the peristaltic effect of vagus stimulation. Curiously, when these results were described to a technician of one of the small hospitals in the city, she volunteered this interesting information⁽³⁾. It is the practice in her institution to send patients for determination of basal metabolic

rates and electrocardiograms at the same time. These people present themselves early in the morning without breakfast. Using a Victor electrocardiograph amplifier type of apparatus, this technician found her string "wandered." She stumbled on the practice of giving her patients a glass of milk before taking her records. She observed that the string then quieted down to give normal tracings.

Summary and Conclusion

1. The peculiar excursions of the string galvanometer associated with increased peristaltic effect are due to hyperperistalsis as observed experimentally in animals and man.
2. This conception receives corroboration from the gratuitous checks offered by the patient with borborygmi and other clinical observations.
3. These effects have usually been discarded without comment or explanation because they were misunderstood.

The application of the electrographic method to peristaltic activity awaits further development and possible clinical application.

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PHYSICAL THERAPEUTIC METHODS IN MODERN DERMATOLOGY

(Exclusive of X-Rays and Radium)*

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Physical therapy has been an important factor in the evolution of clinical dermatology. In the past it was perhaps too important. There was a tendency to become mechanistic, and to employ physical therapeutic methods to the exclusion of general medicine and conventional dermatological remedies. Today the well-trained dermatologist is able, with considerable skill, to employ physical therapy when indicated and to compare and evaluate all established investigative and therapeutic procedures in relation to the individual case. Many of the physical therapeutic methods that were once popular are now used less frequently because they have been replaced by more successful physical and medical measures, especially the latter. For instance, warts of various kinds are now often treated with injections of bismuth or arsenic, and even by psychic therapy instead of using destructive measures. Bacteriophage is now perhaps the method of election for carbuncles along with general medical care. X-rays are used somewhat less frequently for the inflammatory dermatoses, the pyodermas, and so on. To a large extent surgical diathermy has replaced other destructive measures such as the cautery and solid carbon dioxide. So far as concerns skin diseases the abuse of physical therapy is limited largely to physicians who have an inadequate knowledge of either dermatology or physical therapy.

There are a number of physical therapeutic methods, exclusive of x-rays and radium that are indispensable to the dermatologist. They are, in fact, so important that they constitute an integral part of the specialty. Each one of these methods will now be briefly discussed in relation to indications and therapeutic results. Physical, biological and technical details will be omitted because of limited time

and because the audience consists of experts in physical therapy.

Heliotherapy and Ultraviolet Radiation

These methods are useful, but much less so than is generally believed by the general medical and lay public. There is hardly a skin disease for which some physician has failed to claim good results with ultraviolet radiation. Most of these claims are the result of clinical impressions of physicians who have little knowledge of dermatology, who have had a too limited experience with any one condition, or who have failed to guard against coincidence, effect of contemporaneous therapy, and faulty diagnosis, by using adequate controls. Most of such therapeutic claims have not been corroborated and may be disregarded.

Tuberculosis. Ultraviolet radiation, applied locally, in general accordance with the principles of the Finsen-Reyn technic, is valuable for the treatment of restricted areas of lupus vulgaris. General body irradiation with solar radiation or artificially produced radiation is beneficial as an adjuvant to other methods for a few members of the cutaneous tuberculosis group. It seems to be of greatest value for lupus vulgaris and scrofuloderma. It appears to be beneficial, at times, in cases of Bazin's disease, periphlebitis nodularis necroticans, tuberculosis of the hypoderm and the Darier-Roussy type of sarcoid. The consensus among those of wide experience seems to be that the best results, with general body irradiation, are obtained with solar radiation and with artificial radiation whose spectrum approximates that of solar radiation. With few exceptions irradiation has not been successful in other members of this group — tuberculosis verrucosa cutis, Boeck's sarcoid, papulo-necrotic tuberculide, granuloma annulare, etc. Local irradiation may be of some service in orificial tuberculosis, discoid lupus erythematosus and rosacea-like tuberculide.

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* From the Department of Dermatology and Syphilology, New York Post-Graduate Medical School and Hospital, Columbia University.

Pyogenic Affections. Local irradiation is distinctly beneficial in the sluggish types of acne vulgaris — acne indurata. Unfortunately, the improvement is usually temporary. It is less effective in the inflammatory types — acne erythematosus; acne rosacea; acne pustulosa. General body irradiation appears to benefit some cases of widespread acne vulgaris, acne conglobata (acne cacheticorum), and furunculosis. The remedy is of little or no value for the other pustular dermatoses — pustular folliculitis, sycosis vulgaris, pyonchia, acne varioliformis and so on. Local irradiation exerts a favorable influence on many cases of erysipelas but I cannot recommend complete reliance on this remedy. I prefer to employ other recognized medical measures with either x-rays or ultraviolet radiation rather than depend on radiation alone.

Scaly Dermatoses. A great many physicians aver that local irradiation is beneficial for eczema but when this polymorphous affection is considered as a whole, it must be admitted that the remedy is of little value. Erythema doses are contraindicated in the acute and exudative types. Such treatment may prove beneficial but it is likely to do more harm than good. A large dose applied to a patch of chronic, squamous eczema may hasten involution but better results can be obtained with topical remedies. Ultraviolet radiation is of doubtful value in the varieties of eczema known as seborrheic eczema, dermatophytosis and dermatophytide, eczema hemostaticum, infectious eczematoid dermatitis, and the circumscribed form of neurodermatitis. General body irradiation may be helpful in some cases of neurodermatitis disseminata but this affection is so capricious that any remedy is difficult to evaluate.

There can be no doubt but that general body irradiation is beneficial in some cases of the common clinical types of psoriasis. However, a great deal of treatment is necessary and, as with all other remedies, the result is never permanent.

At times parapsoriasis can be made to disappear with exfoliating doses of ultraviolet rays. At the present writing, this seems to be the method of election.

The natural course of pityriasis rosea can be substantially shortened by one or two exfoliating doses of ultraviolet radiation.

Nevi. Good results have been obtained with erythema and blistering doses in cases of ade-

noma sebaceum but too few cases have been treated to permit an accurate evaluation. Similar treatment will often reduce the color of port-wine marks but, as a rule, the result is disappointing.

Alopecia. In the common types of alopecia — alopecia areata, alopecia seborrheica, alopecia systemica, etc. — large doses evoke a hyperemia that may be beneficial, but similar results can be obtained with suitable topical applications.

Miscellaneous Affections. For a time, it was thought that general body irradiation was effective in some of the chronic vesicular and bullous diseases — dermatitis herpetiformis; pemphigus. The remedy is seldom used for this purpose now. Some cases of leucoderma have been benefited by irradiating after painting the area with oil of bergamot. On the whole, ultraviolet radiation is of little value in this affection. A blistering dose of ultraviolet radiation will often make x-ray and radium telangiectasia disappear, but other sequelae such as atrophy, hyperpigmentation and depigmentation may become more conspicuous. Such doses, repeated at intervals of a month or two, may cause some improvement in pitted scars. Chronic ulcers and large wounds often improve as a result of irradiation.

Unfavorable Results. Injudicious irradiation may make inflammatory diseases such as eczema and psoriasis worse or may cause them to change to dermatitis exfoliativa. Herpes simplex and lupus erythematosus may be precipitated by exposure to strong actinic light. A combination of idiosyncrasy (or sensitization) and irradiation may cause urticaria, erythema solare perstans, farmers' or sailors' skin and other undesirable cutaneous and constitutional reactions some of which are dangerous. Farmers' skin eventually develops keratoses and, often indeed, cancer. Pellagra, berloch dermatitis, pseudoachromia parastaria, hydroa estivale, recurrent eruptions on the exposed parts, and conjunctivitis, may be caused or made worse by ultraviolet radiation.

Diathermy

A few dermatologists believe that medical diathermy applied to the upper spinal region is of value for the treatment of lichen planus. It has been claimed by some that medical diathermy is a valuable therapeutic method for scleroderma. I have had no success with this agent in either disease. Fever therapy in syph-

hilis, especially in paresis, has given excellent results. There are a number of ways in which the necessary degree of hyperpyrexia can be produced. The electrical method is in the experimental stage. While the results are interesting and encouraging, it is too soon to attempt a therapeutic evaluation of the method or to predict its future importance.

The three forms of surgical diathermy, electrodesiccation, electrocoagulation and the cutting current, are used a great deal and are of considerable value in dermatology. The electrodesiccating current can be controlled so that a tiny lesion can be instantly destroyed. Coarser sparks are used to thoroughly dehydrate larger superficial lesions. It is not infrequently used erroneously for electrocoagulation; also when it is contraindicated. It is surprising how often physicians employ the method without anesthesia of any kind. Some form of anesthesia is essential except when making instantaneous applications to tiny lesions. The method is indicated only for superficial benign conditions and for a few of the precanceroses. Before using the method in a given case one should consider its advantages and limitations as compared with those of other accepted therapeutic procedures. The resulting scar, for instance, may be inconspicuous, but hyperplasia of cicatricial tissue is more likely to occur subsequent to thorough electrodesiccation than after many other destructive methods. Electrodesiccation is useful for the destruction of a variety of superficial conditions classified under hypertrophies, benign new growths and nevi, among which may be mentioned filiform and digitate warts, the common wart, the troublesome plantar wart, pedunculated fibromas, molluscum contagiosum, warty nevi, selected pigmented nevi, very small superficial basal cell epitheliomas, selected cases of leucoplakia, keratoses, and so on. It is often necessary to curette a lesion after electrodesiccation and then electrodesiccate the wound.

A bipolar high-frequency current is being used for the removal of superfluous hair. I have been experimenting with the method for several years. At first the results were very unsatisfactory. Recently they have been encouraging. I cannot yet recommend it in preference to electrolysis. Both monopolar and bipolar currents are used for telangiectasia. Thus far, in my hands, there has been too much scarring with the monopolar current.

Recently I have tried the bipolar current with more encouraging results, but I am not yet ready to recommend it as a substitute for electrolysis.

Electrocoagulation is employed mostly for the destruction of malignant neoplasms, especially those which cannot be excised, after which the coagulated tissue is removed with the cutting current, scalpel, scissors or curette. It is also used for many superficial conditions that are a little too thick or too deep to be eradicated with electrodesiccation. It is used successfully for the treatment of selected cases of cavernous angiomas and lymphangiomas, especially when situated in the mouth; also for warty tuberculosis.

The cutting current is used to excise malignant neoplasms when the scalpel cannot be used. Many physicians contend that it should be employed to the exclusion of the scalpel in such cases because of the lessened danger of metastasis. The theory appears logical, but as yet I have seen no convincing statistics in support of the contention. The cutting current is not suitable for very small biopsies because the coagulation of cells seriously interferes with microscopical study. The amount of coagulation depends somewhat upon the strength and character of the current and the length of time the current is allowed to act. If quickly done with suitable current it is possible to obtain satisfactory results with all but very small pieces of tissue. Incidentally, it is now the consensus among pathologists and students of cancer that a suitably conducted biopsy does not cause metastasis.

When using surgical diathermy and other forms of electrosurgery, many physicians think in terms of physical therapy rather than in terms of surgery, which is likely to prove inimical to these excellent methods. They belong both to physical therapy and surgery, if you will, but to them should be applied the principles of surgery as well as the principles of physical therapy.

Electrolysis

Electrolysis has been used successfully in dermatology for many years. Many small, superficial, benign lesions can be destroyed with very little if any defect by this method — conditions such as sebaceous adenomas, common moles, etc. It is a successful method for the destruction of dilated cutaneous vessels (telangiectasia). Its greatest value is for the permanent removal of superfluous hair.

For this purpose I prefer a single, very fine, dull-pointed needle and not over one milliamperere of current. When the case is well selected, and the method expertly applied, the results are usually excellent.

Other Destructive Methods

Solid Carbon Dioxide. This is a time-honored and useful method for the treatment of a number of cutaneous conditions. It is no longer necessary to manufacture the snow in the office or clinic. Cakes of hard snow or ice can be obtained from the confectioner who uses it for the so-called "dry pack" in ice cream cartons. The cake can be quickly shaped into any desired size or shape. Therapeutic refrigeration may be used to destroy common warts and various other benign new growths. It is employed in selected cases of pigmented and verrucous nevi, keratoses, angiomas and lymphangiomas, discoid lupus erythematosus, etc. Scars caused by application of solid carbon dioxide are usually of excellent esthetic quality.

Cautery. The cautery, electric or otherwise, may be used successfully for the destruction of warts, keratoses, patches of leucoplakia, telangiectasia, and as an adjuvant in other conditions.

Miscellaneous Methods

Heat is useful for the treatment of some of the pyodermas, particularly boils and carbuncles. It is used, occasionally, to provoke hyperemia in indolent ulcers and the subacute and chronic inflammatory dermatoses. For these purposes heat is applied, as a rule, by means of poultices, water bags, wet compresses, the incandescent electric bulb and resistant coils. Medical diathermy, also, is used for these purposes. As mentioned above, radiotherapy, hot baths, hot cabinets, etc., are being employed for fever therapy.

The galvanic current, so useful for electrolysis, has been recommended for the treatment of keloids and hyperplastic scar tissue. I have not found it of much value for this purpose.

Continuous wet dressings, therapeutic baths and even the continuous bath, are invaluable for the management of the exudative inflammations, the pyodermas, pemphigus and, at times, for the scaly and pruritic dermatoses.

Massage is used for scleroderma, alopecia, hyperplastic cicatrix, keloid and a few other conditions. Posture, strapping and elastic stockings are important in cases of chronic

varicose eczema, indolent ulcers, the congestive dermatoses, and so on.

200 West 59th Street.

Discussion

Dr. Henry D. Niles (New York): I also have found generalized ultraviolet radiation to be of distinct benefit in the treatment of pityriasis rosea. Two or three treatments a week for two weeks usually shorten the duration of this disease to one-half or one-third of its usual course. I have not had Dr. Wise's experience that ultraviolet radiation is of benefit in the ordinary type of alopecia, even though treated early. This may have been because my patients did not continue this treatment as long as his.

I should like to mention the treatment of alopecia areata and nevus flammeus with intensive doses of ultraviolet radiation with the water cooled (Kromayer) lamp. The addition of the Wood filter to this lamp is of great benefit in the diagnosis of tinea capitis, as the infected hairs give a typical green fluorescence under this light. I should like also to mention the treatment of alopecia with Oudin high frequency electricity. I have found this treatment much superior to ultraviolet radiation.

I have treated some patients with nevus flammeus with grenz rays. At first, the results were encouraging, but later this treatment seemed to have little effect and I have abandoned it in favor of the Kromayer lamp or carbon dioxide snow. In a recent article in the *Journal of the American Medical Association*, Nightingale and Starr found that the treatment of erysipelas in children with erythema doses of ultraviolet radiation was more successful than the serum or combined treatment.

Dr. Anthony C. Cipollaro (New York): In a discussion of this kind, I think it is important to say something about grenz rays. The conception that grenz rays are Roentgen rays of long wave lengths is now generally accepted. Therefore, the penetration of these rays is limited. Taking advantage of this principle, we find that grenz rays are particularly suitable for treating lesions of the eye lids including epithelioma of the basal cell type without the danger of the rays penetrating through the eye lids to the cornea, causing opacities, as is likely to happen with the harder Roentgen rays. Lesions of the scalp such as epithelioma, psoriasis, dermatitis seborrheica, neurodermatitis of the circumscribed variety, etc., may be treated with grenz rays without the danger of producing radiation alopecia. Eczema, lichen planus, psoriasis, etc., occurring on the scrotum may be treated with grenz rays without the danger of affecting the spermatozoa. Medico-legal complications may thus be avoided by treating scrotal and penile lesions with grenz rather than x-rays.

Radiodermatitis is less likely to occur when using grenz rays for those diseases which have a tendency to recur in the same localizations, such as neurodermatitis, psoriasis, pruritus ani et vulvae, dermatophytosis of the hands, etc. Although grenz rays are not capable of produc-

ing ulcerations (third degree radiodermatitis) yet the late results of over-radiation are the same with both grenz and Roentgen rays.

A subject which has been under investigation for over three years has been the value of medical diathermy in the treatment of lichen planus. Mestre of Havana, Cuba, was the first to use this method. In my hands, the method has been moderately successful. I have cured some, improved some, particularly the intensely pruritic ones, and failed to influence either the objective or subjective symptoms of the majority of the cases which I treated. Perhaps with more experience and improved technic, we may be able to report better results.

Dr. J. P. Guequierre (Philadelphia): In the short time allotted him, Dr. MacKee has given us an excellent cross section of the rôle of physical agents in the field of dermatology. I was

glad to hear him sound a conservative note. One cannot treat the majority of skin diseases with physical agents alone; the prescription pad is still the keystone for our dermatologic therapy, and a thorough grounding in the fundamentals of diagnosis is just as essential to success as it ever was.

I regret that Dr. MacKee's time was so short, as there are a number of problems on which I would like to have had his opinion. About a year ago, Dr. Frank H. Krusen interested me in using the cutting current to obtain my biopsy material. Prior to that time I was skeptical about this method, but his success converted me and we are now using it on all but the very smallest lesions. Our pathologists share our enthusiasm and report that when properly done, the line of coagulation — necrosis — is so small as to offer no objection to this method.

PHYSICAL THERAPY IN INDUSTRIAL INJURIES *

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The scientific application of physical measures to industrial injuries is being more widely adopted because it holds out promise to cure principal causes of disability, shorten the disability time, and lessen the degree of permanent disablement. It is a form of treatment, when applicable, that is recognized as one of the best for an injured employee who is insured under our Compensation Law.

The Compensation Law is based upon the principle that the burden of relief for an industrial injury is placed upon the industry in which the accident occurred. In doing this, medical and surgical treatment is provided for the injured according to charges usually prevalent for people in similar circumstances, and corresponding financial standings in a similar community.

The three principal causes of disability are (1) pain, which was the chief cause in 84 per cent of a series of industrial injuries studied, (2) weakness, which was the second outstanding complaint, found in 82 per cent of this series, and (3) loss of motion, which was the third important symptom and found in 67 per cent of the series. Each of the above symptoms can be successfully treated by physical therapy, but a complete general

knowledge of the action of each modality is necessary in order to obtain the best results. When the chief causes of disability are under control, the work of repairing residual symptoms will take on new impetus, so that tissues and affected parts will respond with greater certainty to the treatment under prescription.

Industrial Physical Therapy

By the term "Industrial Physical Therapy" we mean the application of physical therapy in industrial injuries in such a manner that the disability period is shortened and the injured employee is able to be discharged in a more normal condition than otherwise. Treatment time may be shortened by a more accurate knowledge of the specific action of individual modalities. In a like manner, a better control of symptoms causing disability is also made possible. In order to enhance the effect of treatment, a practical form of suggestive therapeutics or psychology is advocated.

Psychology in the sense here considered is a form of treatment that few physiotherapists study or use to its fullest extent. It is of great importance, especially so to the surgeons treating industrial injuries. It takes into consideration the mental condition of the patient and attempts to prevent him from be-

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 12, 1933.

coming discouraged. Neurotic tendencies are combated as soon as discovered. The confidence of the injured must be gained to obtain good results, hence the physiotherapist should maintain a confident and a positive character. Personal interest must be taken in the case, and the injured individual must be assured that he is making favorable progress in some degree throughout his treatment. By the same token one should not discuss the nature of the injury in the presence of the patient, and in no instance let him believe that "something is not right."

Accurate diagnosis is of importance in obtaining the best results. The involved body structures should be known so that an approximate form of treatment can be worked out. Unfortunately, only a small per cent of diagnoses is correct anatomically. This, naturally, affects the end results. In a study of 220 industrial injuries, I found only 24.6 per cent of the diagnoses correct, this of course, in accordance with my own definition of a good diagnosis. In these cases I considered one in which the location, severity and a good description of the injury were given. In 20.9 per cent I was unable to obtain any idea as to the nature of the injury.

Treatment

Treatment of long duration should be discouraged, except in rare instances or in complicated cases. The longer the number of treatments, the more the tendency of the individual to develop neurotic symptoms and to believe that "something is wrong"; or that he is more severely injured than he was led to believe. In order to obtain the best results, the use of several modalities in one treatment is advisable. An average treatment would consist of some form of infrared baking, some high frequency application, and possibly, some electric muscle stimulation. Massage and exercise, and in certain conditions, a tonic dose of ultraviolet radiation may be given. I have found the non-vacuum electrode a very valuable form of high frequency treatment in the average industrial injury. If there is deep congestion, then the infrared generator is best, otherwise I am a great advocate of radiant baking.

An average treatment time should vary from twenty to forty minutes. This will, of course, depend entirely upon the case to be treated. During the treatment the injured part must be in comfortable position and at

ease. The part that is to be treated should especially be relaxed. The treatment should not be "rough," but should be given in such a manner as to gain the confidence of the patient.

Results of Treatment

In the present report a total of 601 cases are being analyzed and the treatment results given. In each of these cases, the injured employee was either entirely cured or returned to work in as normal a condition as possible. These cases were all treated by the writer and were under his complete supervision as regards the agencies utilized and as to the length of each treatment. The injuries were all of simple nature, unless otherwise stated.

Skin. In industrial injuries, the cutaneous portion of the body is frequently injured. In most instances, surgery can successfully unite the edges of any laceration. If infection occurs, then an ulcer may develop which may be very painful and difficult to treat. A non-vacuum electrode connected to the monopolar terminal and with a current of high voltage and low milliamperage will, in most instances, successfully combat any pain and soreness, and stimulate healing action of the ulcer. An ulcer can also be safely cauterized by means of a high milliamperage and low voltage high frequency current. This current is the type which produces a superficial effect when so desired. The monoterminial current mentioned, is best employed when nerves are inflamed. The following is the treatment time required for several skin ulcers.

TABLE 1
Treatment of Leg Ulcers

Area	Duration Before Treatment	Size of Ulcer	No. Treatments	Days Until Cured
Lower shin (1)	1½ months	50c	4	7
Lower leg (20)	6 weeks	4" in Diam. (Largest)	12	21
Leg, shin (1)	3 weeks	25c	4	4

Nerves. The most common nerve injuries are reflex neuralgias and the so-called "traumatic neuroma." Both of these conditions readily respond to appropriate treatment by physical means. If an acute neuritis is present, care must be taken not to use intense diathermy, otherwise the condition will immediately become aggravated. In treating nerves, try to localize the site of injury or disease, and then apply an appropriate treatment to that area. Also remember that any symptom may be referred, so that it is of utmost value to know the location of any

pathology and the seat of the injury. The following are some results from treating neuralgias:

TABLE 2
*Treatment of Nerve Injuries**

No.	Area	Physical Therapy Treatment	Day Returned to Work	Day Cured
12	Radial nerve, forearm.....	5	7	7
16	Ulnar nerve, forearm.....	10	16	16
20	Great sciatic nerve — uni-lateral	7	11	11
5	Facial — uni-lateral	5	7	7

* An average of seven treatments was given in these 53 cases.

Muscles. All muscle injuries can readily be treated by physical means, especially if a partial rupture of the muscle fibers is present. In this condition, unless treatment is started early, fibrositis may develop and the disability period prolonged. If it is desired to train a muscle, then the Bristow Coil is one of the best modalities to use. Very good results can be obtained as the current of this coil is readily controlled. If a fibrositis is present, faradic massage of the area is an excellent treatment.

In training muscles, mild resistant exercise should be given. By this method, results are obtained in a quicker and shorter time than otherwise. Do not use too much resistance in order not to overtire the muscle. An overtired muscle is one in which the reaction to treatment is slow and the same may be greatly prolonged. The following are some muscle injuries and the results:

TABLE 3
*Results of Physical Therapy in Muscle Injuries**

No.	Area	Physical Therapy Treatment	Day Returned to Work	Day Cured
26	Lumbar muscle strain.....	2	5	5
40	Strain of quadratus lumborum	4	4	4
5	Ruptured muscle fibers of biceps femoris.....	8	10	20
10	Ruptured muscle fibers of forearm	8	10	12

* An average of about six treatments for muscle injury in 81 cases.

Ligaments. Ligaments are, at times, difficult to treat, as they may be deep-seated and hard to reach. They should be kept relaxed and supported as much as possible, and during treatments, always supported. In treating inflamed ligaments it must be remembered that when they are stretched pain is elicited. If the ligaments are superficial then radiant heat should be given; should the ligaments be deep, then penetrating heat or diathermy

should be applied. Before treating these injuries care must be taken that a "fascitis" is diagnostically ruled out. Flushing a "fascitis" with blood will speedily increase the soreness and provoke symptoms of pain, as already mentioned, is one of the chief causes of disability.

The following are results obtained in the treatment of injured ligaments:

TABLE 4
Physical Therapy in Ligamental Injuries

No.	Area	Physical Therapy Treatment	Day Returned to Work	Day Cured
72	Lumbo-sacral ligament ..	6	9	9
57	Sacro-iliac uni-lateral ...	9	12	12
18	Lateral lumbo-sacral joint	10	14	14

This would make an average of about nine treatments for a ligament of this nature in 147 cases. For ligaments, strains of small joints and joints the size of the ankle or knee, the number of treatments will run from six to twelve treatments as an average.

Bones. A bone is usually either fractured, contused, or inflamed. Should a fracture be present, then appropriate treatment will readily reduce the swelling and tend to remove any excessive exudate in the soft tissues. Diathermy applied to bone requires longer treatment time than one applied to soft tissue on account of resistance to electricity. A penetrating effect is needed. Often a localized periostitis will readily respond to either a penetrating diathermic current, or to mild electric massage, if the periostitis is superficial. The following are some treatment statistics of bone injuries:

TABLE 5
Physical Therapy in Bone Fractures

No.	Area	Physical Therapy Treatment	Day Returned to Work	Day Cured
23	Fibula styloid at ankle....	12	26	63
15	Tibia and fibula shafts....	33	141	144
6	Tibia shaft	29	63	79
4	Os Calcis, uni, simple.....	9	44	47
12	Distal end of radius.....	8	29	30
6	Clavicle	10	49	56
100	Fingers	12	33	33

Joints. Treatment of joints is very important. Careful study should always be made, so that an accurate anatomical diagnosis may be ascertained. In a cartilage injury, penetrating diathermy is of great value, as it is one of the few conservative methods of treatment that can be applied, to reach the injured area. In arthritis, excellent results

are often obtained by the use of diathermy. The diathermy should at first be penetrating, and should be followed by a perithermy, the latter lasting approximately one-third of the time of the former, the whole treatment totalling on an average of about one-half an hour. In smaller joints, or for a superficial lesion, electric massage is of great help. The patient holds the electrode as closely as possible to the injured joint, and the operator massages lightly over the tender area and the joint. The electrode is connected to the monopolar terminal. It must be remembered that the spine has many joints that may be readily sprained. A good diagnosis is necessary in these spinal cases. With these joints sprained, treatment can be readily applied and worked out, so that a cure will result in reasonably short time, otherwise the disability period may last weeks or months. A good illustration of this is the lateral lumbosacral joint. This condition can be cured in a week with appropriate treatment, or it may last months if the lesion is not recognized and appropriate treatment applied. The following are some results with respect to joints.

TABLE 6
*Physical Treatment of Sprains**

No.	Area	Physical Therapy Treatment	Day Returned to Work	Day Cured
15	Ankle—mild	2	2	2
8	Ankle with ligament strain	5	8	8
14	Wrist—mild	3	3	3
10	Wrist with ligament strain	12	14	14
8	Elbow with ligament strain	12	15	15
22	Contusion and sprain knee joint	8	14	14

* This is an average of seven treatments per individual in these 77 cases.

TABLE 7
*Physical Treatment of Arthritis**

No.	Area	Physical Therapy Treatment	Day Returned to Work	Day Cured
8	Sprained ankle with arthritis	20	26	26
15	Sprained wrist with arthritis	24	32	33
16	Articular lumbago	6	8	8
8	Knee joint with rheumatic arthritis	17	42	42
10	Shoulder joint with traumatic arthritis	25	35	35

* An average of eighteen treatments for each of these 57 cases.

Bursitis. Traumatic bursitis may occur at

any time following an injury, and is very often the condition of greatly prolonged disability, especially in those of advanced age. A bursitis may readily become complicated due to the spreading of inflammation and involvement of neighboring structures, as nerves and joints. An accurate diagnosis should be made and the treatment planned as to give good protection to this area. The following are some of the results that can be obtained in treatment of traumatic bursitis:

TABLE 8
*Results of Physical Treatments in 53 Cases of Bursitis**

No.	Area	Physical Therapy Treatment	Day Returned to Work	Day Cured
15	Subcoracoid	11	14	14
14	Subacromion	8	12	12
8	Supra-patella	6	7	7
6	Clutius maximus	12	21	21
10	Subcutaneous acromion ..	4	5	5

* An average of eight treatments for each of 53 cases.

It must also be remembered that in a bursitis involving the shoulder joint, the possibility of foci of infection should be ascertained, especially the oral cavity. Many times the teeth and tonsils are the cause of prolonged inflammation and pain in the subacromion or subcoracoid bursa.

Mechanics of Accident

In order to obtain successful results with physical therapy in industrial accidents, the mechanics of the accident must be thoroughly studied. We must ascertain, for instance in a case of back injury, whether the lift was directly upward from the ground, or if it were from a level above the head. We must also know whether the spine rotated, or if there was any unforetold accident, such as slipping, falling or being struck while in at work. The weight of the object causing the accident should be ascertained. When the mechanics of an accident is understood, it is surprising how it will assist in the diagnosis of injuries, especially of the spine. The mechanics of injuries in sprained joints is also important. If the claimant states that his foot turned one way, and he suffered a severe strain, and yet no complaint of pain is made to tension or pressure on the ligament that should have been strained, then we may suspect that some other condition is present, in the nature of a disease, and that no actual injury occurred. It must be remem-

bered that a severe injury may occur from a minor accident. I lately found a patient in whom a compression fracture of a vertebra resulted from the placing of the foot too strongly and too suddenly upon the foot-brake of an automobile. It is wise to remember and to consider after examining the injured part, the following questions:

1. Is it possible for the claimed accident to cause the present injury and resulting symptoms?

2. Are the symptoms present caused entirely by pathology present?

Malingering

In my experience I have found that true malingering is not common. There is, though, a marked tendency to exaggerate symptoms in many cases. Some of these cases are partially true malingering, but in other cases the exaggeration of symptoms is due to a neurotic tendency. It must be that when a man is accused of malingering, one should fully consider and study his case. Malingering is a condition which should be proven, and not taken for granted. In proving the same, one should have x-ray proof that no pathology of bones is present. The symptoms complained of are out of proportion and not based on anatomical structures. The anatomical basis will be found to be incorrect for the symptoms of which the patient complains. The mechanics of the accident will also vary. An excellent way to prove these conditions is through electrical stimulation, and the Bris-

tow Coil is one of the best. If the patient complains of tender nerves or of a neuralgia, or of a neuritis, then stimulation with the Bristow Coil will greatly aggravate these conditions, if pathology is present in the nerves. It should also be recalled that a muscle contraction caused by the Bristow Coil, is a contraction which occurs only after voluntary control is present. It should be kept in mind, however, that the injured individual may have forgotten how to use the muscle, and therefore a slight degree of muscle training should be given before the reaction to the Bristow Coil proclaims a man as a malingerer.

Conclusion

Physical therapy is of value in industrial injuries because it produces excellent results when intelligently applied. However, even with the use of physical therapy, if a correct diagnosis is not made, and a good working knowledge of the necessary modalities is not at hand, the disability period may be prolonged and the results may not be good. There are many cases on record in which the disability period has been prolonged three and four times longer than the average length of disability, owing to incorrect physical therapy applications. However, with the correct use of physical therapy, both the anatomical and psychological elements taken into consideration, the disability period will be shortened and reduced to a minimum.

333 Pine Street.

THE GALVANIC CURRENT IN ATROPHIC RHINITIS *

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Atrophic rhinitis is a chronic disease of the nasal mucosa, characterized by excessive dryness of the nose, and a diminution or loss of the sense of smell.

The etiology of atrophic rhinitis is not definitely established, but it is usually secondary to chronic sinusitis or conditions of improper aeration. It sometimes follows intranasal oper-

ations, especially in cases where the turbinates have been removed.

In the normal nose the mucous membrane is of two kinds, one covering the olfactory area and the other, the respiratory area. The olfactory portion is of a yellowish color and is limited to the upper third of the septum, the roof of the nose and the lateral nasal wall as far down as the upper portion of the middle turbinate, which is approximately at the

* Read before the New York Physical Therapy Society, February 1, 1933.

same level as the border of the septal olfactory area. This membrane is covered by non-ciliated epithelium and contains the perceptive olfactory cells.

The rest of the nasal cavity, with the exception of the vestibule, comprises the respiratory area. This portion is covered with ciliated, stratified columnar epithelium, beneath which is the basement membrane and tunica propria, a well-developed layer containing fibrous and elastic elements, having a rich blood supply. There are numerous mucosa, serous and mixed glands, and also a large number of lymphocytes clumped together to resemble lymphocytic nodules.

Changes in Atrophic Rhinitis

In atrophic rhinitis, the important pathological changes are a loss of the cilia and a thinning of the mucous membrane. The latter loses its elasticity, becomes fibrotic, and the calibre of the blood vessels is decreased, resulting in a diminution of the blood supply. There is the usual lymphocytic infiltration seen in chronic infections without involvement of the underlying bony structures, thus being distinguished from the clinical entity of unknown etiology called *ozena*. The latter, often used interchangeably with atrophic rhinitis, will not be discussed in this paper.

The symptoms of atrophic rhinitis are due chiefly to the dryness of the nose. The mucus clings to the membranes, often forming crusts on the posterior surface of the nose and the nasopharynx. The throat is often the seat of a chronic irritation due to the failure of the mucous membrane to humidify and temper the inspired air. There is always some diminution in the sense of smell, and in marked cases, a complete anosmia. Secondary symptoms of loss of weight and of gastrointestinal disturbances are often present.

The prognosis regarding a complete cure of atrophic rhinitis is not good, for the cilia cannot be replaced, once they are lost. The number and variety of agents that have been advocated in the treatment of the disease offer sufficient evidence of their inefficacy. The chief hope of the physician for relieving these patients lies in the stimulation of the intranasal mucous membrane with a view of restoring it to as healthy a condition as possible. This is the rationale of a method of treatment I wish to present. However, before describing the local treatment which I advocate,

attention is directed to the need of improving the general health, and of eradicating all local contributory causes, such as sinus disease.

The topical treatment that has proven most satisfactory in my hands over a period of six years is the galvanic current. We depend solely on it for its stimulating effect on the mucous membranes and nerve endings, and not on any chemical effect of some medicinal agent, such as zinc sulphate being driven into the membrane by the current. We find that the stimulation of the mucous membrane tends to restore its normal physiologic functions, and the stimulation of the olfactory nerve endings definitely improves the sense of smell.

The method I employ is as follows: The nose is thoroughly cleansed by the wet suction method, using warm physiologic saline solution. The fluid is run into one nostril, the head being lowered, while the patient says "K-K-K-," and the return flow is sucked from the other nostril into a suction bottle. The nasal tips are alternated several times during the procedure, so that the nose will be thoroughly cleansed of all mucus and crusts. The nostrils are now packed with successive layers of absorbent cotton strips which have been dipped in normal saline solution. These should completely fill the nose from the floor to the roof, taking particular care to include the olfactory area. The cotton strips should be long enough to extend one-half inch out of the nostrils.

The electrical apparatus required is the simple galvanic wall plate. Either of the poles may be used as the active electrode, and it is my practice to alternate them, making the positive pole the active electrode for one and the negative pole for the succeeding treatment. The active pole is attached to the protruding cotton, and the inactive pole is held in the patient's hand or is attached to his arm. The current is now turned on, and the rheostat moved up slowly until the patient experiences a salty taste in the mouth. The milliammeter reading is usually between 5 and 10. The current should be applied for 15 minutes, then the rheostat is moved back slowly, the current turned off, and the packs are removed. Following this, an oil such as balsam of peru in castor oil, or Mandl's solution is now applied to the membrane. These treatments are given three times weekly at first, and, later, as improvement is noted, at greater intervals.

Improvement occurs when the membranes become redder, moister, and thicker. The post-nasal discharge lessens and the sense of smell is markedly improved.

Discussion

Dr. Lewis J. Silvers (New York): As demonstrated by Dr. Stovin, gratifying results are obtainable by cataphoresis or iontophoresis. Of particular note is the fact that the patient has now a return of sense of smell after an anosmia which lasted five years prior to treatment.

Patients suffering from an atrophic condition of the nasal mucosa come to us primarily with the complaint that they have no sense of smell. Some in the more advanced stages which border on an Ozena, complain bitterly of the ever-present maleodor. A pure case of atrophic rhinitis may be completely cleared up by galvanism according to the technic of the essayist. Fortunately, the mucosa containing the olfactory nerve filaments is capable of rehabilitation. We can never replace the ciliated mucosa which in con-

junction with the Schneiderian membrane completely fulfills the nasal function of warming the inspired air, cleansing and filtering, and moistening it when dry.

The majority of cases show evidences of a complicating necrosis of the cartilage and bone, a true progressive Ozena. Here, modern physical methods offer relief so far unattainable by other methods. First, cleaning up the necrotic debris by means of fulguration and subcoagulation is essential. Second, the stimulating effect of the cold quartz, with its bactericidal action is most efficacious as an adjuvant of more than conservative value. Lastly, the use of the galvanic current is necessary for the re-establishment of the normal Schneiderian membrane.

It is of importance to note here that we may extend the hope of the return of the olfactory sense in the anosmic patient after many years of dysfunction. In my own experience I have noted the return of the sense of smell after ten years anosmia complicating a progressive atrophic rhinitis.

SODIUM RICINOLEATE FOR COLONIC MEDICATION *

C. A. STIMSON, M.D.

LANSING, MICH.

Sodium ricinoleate, a derivative of castor oil,⁽¹⁾ has recently come into favorable commendation as a detoxificant par excellence. Employed for colonic medication in the dosage described below, it offers splendid opportunity for aiding the elimination of toxic and infective products from the colon and improving the general health of the patient.

Larson⁽²⁾ has recorded the detoxification of tetanus, diphtheria, streptococci, pneumococci toxin and tuberculosis bacilli, and with McKinley has described the production of active immunity against monkey poliomyelitis by the use of ricinoleated vaccines. Much work has been done on the treatment and prevention of diseases with ricinoleated vaccines prepared from these sources.

When injected in small doses into living tissue it produces an antitoxin precisely analogous to those produced against bacteria. Sodium ricinoleate is not a germicide. It has, however, the property of combining with the decomposition products of bacteria, thus pos-

sessing the power of detoxification. Since detoxification is an absorption phenomenon, the toxin molecule apparently absorbs ricin, rendering it inert in its action upon tissues. When injected in sufficient amount, it is followed by reaction with fever, rigor and chill, corresponding to a protein reaction from dead bacteria.

As a chemical agent sodium ricinoleate approaches the ideal in its efficacy as an intestinal detoxicant. According to Fantus, "The Castor Oil Cure (a course of daily doses of castor oil), has relieved many an obscure case of abdominal pain and incidentally made the diagnosis. In case of abdominal pain in which an intestinal obstruction is suspected, castor oil is probably the least objectional of the reliable cathartics." The early writers commented that castor oil possessed a virtue apart from its purgative properties, that made it the remedy of choice in cases of food poisoning. Larson has scientifically demonstrated and explained that the purified castor oil soap possesses the unique property of neutralizing toxin and is detoxicating. Since the cathartic

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 12, 1933.

action of the oil is evanescent, it is saponified in the bowel. Given in small, repeated doses it is constipating. Larson points out that the chemical action of the oil is changed to ricinoleates in the intestines. Sodium ricinoleate as a detoxifying agent exhibits to a much greater degree the same effect as castor oil but without the cathartic action or secondary constipating effect.

Rosser⁽³⁾ offers a word of warning regarding the use of oil. In his exhaustive study of Eliaoncus (a term he coined for oil tumors), he reports partial occlusion and rigidity of the lower part of the rectum, in many individuals who have received phenol oil injections. He also calls attention to tumors similar in appearance to adenocarcinoma and suggests the elimination of oil as a carrier, to avoid this complication in the non-surgical treatment of hemorrhoids.

During the past two years we have treated over a hundred cases of various types of intestinal toxemia with sodium ricinoleate. This group included varying conditions, most common among them being the atonic colon. Bassler⁽⁴⁾ has pointed out that autopsies reveal small hemorrhagic lesions, with destruction of the follicles and a degeneration necrosis in the mucosa, mainly in the glands and lymph nodes, and with definite desquamation of glandular tissue. In instances of long standing mucous membrane pathology, the cells of the Meissner and Auerbach plexuses are shrunken, stippled with a fine granulation; the nuclei and neurons showing distinct change from normal. It is evident, therefore, with impairment of the sympathetic chain, dilatation of the organ to which these fibres are distributed must occur causing a vicious cycle. Beginning with infection within the gut, there occurs a transformation of the mucosa, an increase of the disintegrating and lytic products of bacteria thus altering the function of the ganglia and neurons of the sympathetic plexuses, and a consequent dilatation and deficiency of the dynamics of the gut. Therefore, in all instances of atony, there is found a mild degree of mesenteric ileus, an incompetent ileocecal valve, a mobile and dilated cecum, with elongated ptotic and spastic colon, and its sequela of chronic ulcerative colitis. Chronic constipation is a common condition, because of atrophic changes in the gut, due to long standing intestinal toxemia. Dry colitis,

or colitis sicca, may also be a corollary. Colitis with its secondary neurological changes, such as mucous colic or membranous colitis, diverticulosis and diverticulitis is not an uncommon experience. The infections attendant upon these conditions are usually of the mixed or associated groupings, the organisms producing definite proteolytic effects from the food pabulum within the tube, thus completing the cycle.

Treatment

The variety of treatments recommended for these intestinal conditions are almost as numerous as the men engaged in this type of work. Our appreciation of this fact has prompted us to adopt a treatment which has proved more successful than any that has heretofore been described. Our treatment combines the correction of the biologic factors and the modification of diet. Before commencing treatment the patient is subjected to a thorough examination, to determine whether or not the intestinal tract is the real seat of the trouble, and to eliminate all other possible factors. A complete biologic laboratory report is obtained in every case. Thorough x-ray examination of the abdomen is made, followed by a sigmoidoscopy.

We agree entirely with Rankin⁽⁵⁾ that "The only positive way of studying any colonic condition is by means of the x-ray through the use of a barium enema by the double contrast method."

In accordance with the method advocated by Bastedo,⁽⁶⁾ the colon is prepared for treatment by thorough irrigation with plain water and is terminated when convinced that the colon is clean. For the inflow I use a soft rubber velvet-eyed catheter, number 20 to 24 French, inserted from 5 to 6 inches; for the outflow, a velvet-eyed closed-end rectal tube number 30 to 32 French, inserted from 3 to 4 inches.

The medication used consists of one quart of a 1 per cent sodium ricinoleate solution to cleanse and detoxify the colon. Sodium ricinoleate has proved the most satisfactory means we have found for cleansing the colon of patches of mucous. This treatment with sodium ricinoleate solution is repeated two or three times a week depending on the severity of the case, and continued once a week as long as necessary.

Coincident with this treatment, the patient is placed on a bland diet, and to detoxify the

upper bowel, soft gelatin capsules of purified sodium ricinoleate are prescribed. Usually five to ten grains of sodium ricinoleate is given three or four times a day on an empty stomach. In severe cases the dose may be increased. In all cases the use of capsules of sodium ricinoleate is continued over a period of several months, or until there is complete amelioration of symptoms. We have been able to obtain satisfactory results with this treatment in from one to twelve months according to the condition found and the severity of the case. Our results are checked at frequent intervals by stool cultures and x-ray and sigmoidoscope examination, so that the progress of the case can be determined. Only the purified sodium ricinoleate is suitable for internal use, and should be especially prepared for internal administration. We have used the capsules described by Morris and Dorst in their work, with satisfactory results. After using many forms of treatment and comparing the results we have observed that our patients respond more readily to treatment with sodium ricinoleate.

115 West Allegan Street.

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Discussion

Dr. La Rochelle (Springfield, Mass.): There are two well defined conditions that readily group themselves under the heading of allergic reactions. The best known are the respiratory, mucous membrane, and skin reactions. Another is the disturbance in the organism resulting from retained pieces of placenta. We are all familiar with the chills, fever, pain in the bones and joints resulting from retained secundines. In this day when it is the fad to ascribe all conditions ac-

companied with fever to infections it is easy to explain these reactions by the infection theory, but this explanation is not entirely satisfactory. The fact that the symptoms disappear immediately on removing these remnants make it much more probable that these disturbances are the result of the breaking down of molecules of the placental proteins that give rise to conditions very similar to allergic reactions, and that the site of these disturbances is not the uterine cavity itself but the reticuloendothelial system. It is also probable that the chemical structures responsible for these reactions are not completely elaborated in the uterus but are in the nature of a radical that finds its complement in the reticuloendothelial system and completes a molecule which is the cause of the trouble.

Similarly with intestinal toxæmias. If it has not been possible to isolate the toxic products from the intestinal tract that give rise to toxæmias, it may be that again, here, we are dealing with incomplete toxic molecules that find their mates in the body humors, to produce the well known symptoms commonly referred to as intestinal toxæmia.

The separation of castor oil into its cathartic and its detoxifying component is a good instance of the achievements of modern science. Experience alone was sufficient long ago to convince careful observers that castor oil has an effect quite apart from other cathartics, magnesium sulphate for instance. But it is only since the work with sodium ricinoleate that the explanation of these phenomena has become clear.

The hypothesis that intestinal intoxication is due to organic compounds absorbed from the intestinal tract is entirely too simple. With modern apparatus it is readily possible to empty and wash thoroughly the human colon and yet we know that this alone will not cause the entire disappearance of symptoms usually referred to as intestinal toxæmia.

It appears to me that the work with sodium ricinoleate is not only valuable in the sense that a new weapon has been forged in our struggle with intestinal intoxications, but that a hitherto unexplored field has been opened up for investigation.

If we disabuse our minds from the intestinal poison idea and look upon intestinal toxæmia as a reaction brought about by absorption of radicals from the intestinal tract that form new and toxic compounds in the organism, we are well on the way to securing a hearing from internists. It is my opinion that this work with sodium ricinoleate will be found to be the first guide post that will lead to a better understanding of upsets of intestinal origin.

SUBMUCOUS COAGULATION OF HEMORRHOIDS *

NOAH ZEHR, M.D.

FORT WAYNE, IND.

By submucous coagulation of hemorrhoids is meant the destruction of the varicosity without injury to the overlying mucous membrane. Operators familiar with the coagulation effect of tissue will readily see a diametrically opposite point of attack. Neoplasms and tonsils are destroyed from the surface downward. Submucous coagulation means destruction of deeper structures without affecting the surface, or at most producing only a minimum amount of surface trauma.

My experience is based on the study and results obtained upon sixteen patients so treated. A bi-terminal high frequency current was used, the same as in coagulation by electrosurgery. This treatment has been successful in the type of hemorrhoid that may dilate, collapse, rupture and bleed, or protrude during defecation or physical exertion.

The cases most selectable for this form of treatment should manifest a minimum of proctitis and edema, and no thrombosed veins. The contraindications to this method are, therefore, proctitis with edema, thrombosed hemorrhoids and prolapsus of the anal canal. I also exclude the external skin tags seen around the anus.

The technic used is based on the theory of destroying the endothelial lining of the varicosity without destroying the anal mucous membrane. In order to do this I have devised a special electrode which consists of a steel wire $1\frac{1}{2}$ inches long and of a diameter similar to an 8 gauge tonsil snare wire, mounted in a base suitable for the electrode handle. The point of the electrode is as sharp as a hypodermic needle.

The preparation of the patient should be the same as for any minor anal operation. One's examination and diagnosis should be the guide for the type of treatment to be used. If the hemorrhoid can be fully protruded I so prefer it. If the hemorrhoid cannot be protruded I use a Brinkerhoff speculum.

In about one-half of the operations so performed, the patient was able to protrude the hemorrhoid by straining as when he moves his bowels. In this type the gloved finger should be placed in the rectum while the current is on in order to control over coagulation and destruction of rectal mucous membrane. If the current is sufficiently strong to burn the patient, you will also burn your finger. Illumination of the field may be by direct light or by head mirror reflection.

Anaesthesia is obtained by topical application of 10 per cent cocaine solution. I find it most convenient to anaesthetize and operate when the patient is lying on the same side of the located hemorrhoid. I prefer to treat hemorrhoids that can be protruded. Sometimes protrusion can be produced by inserting the gloved finger and withdrawing while the patient bears down. Protrusion may also be induced by expelling the contents of a small enema which may be given in the office with a syringe.

When the anaesthesia is complete the electrode can be introduced into the hemorrhoid without pain. The terminal should be inserted at a convenient point and at an oblique angle, as to enter the lumen of the varicosity in its long axis. It may then be advanced in the lumen of the vein until resistance is met, which indicates contact with the rectal wall. The electrode should then be slightly withdrawn, to prevent injury to the structure offering resistance. The deep musculature in this region should be avoided.

The diathermy apparatus should be operated with a foot switch and regulated as for tonsil coagulation. The inactive terminal of the machine may be attached to the rectal speculum if one is used, or placed in contact with the patient by means of a metal plate as in any coagulation procedure.

When a long slender terminal is inserted into living tissue and the high frequency current turned on, coagulation starts at the tip. As the electrode becomes insulated with coagulated tissue the activity ap-

* Read before the Allen County Medical Society, Fort Wayne, Indiana, April 17, 1934.

proaches the point of insertion. Therefore blanching and coagulation of the mucous membrane at the point of insertion is the *signal to stop*. The average time required is three to five seconds.

When the electrode is withdrawn a slight tug is felt. The electrode will be covered with a thin film of coagulated blood. Frequently there is no bleeding from the puncture; at most there may be a few drops of blood. If more than a slight oozing of blood occurs a light fulgurating touch will check it. Not more than two insertions and coagulations should be made in a large varicosity at one treatment.

When the treatment has been completed, the speculum should be gently withdrawn. The gloved finger may be inserted into the rectum to push the hemorrhoids and mucous membrane up as far as they will go, then it is gently withdrawn while the patient is relaxed. After the treatment is completed only a slight induration, if any, can be felt in the area of coagulation. Sometimes the patient feels an insignificant, painful sensation of weight in his rectum. This soon disappears and is undoubtedly due to the anaesthesia, the trauma of the speculum, or the coagulation. Before the patient leaves the table I usually introduce an astringent ointment into the rectum.

The danger, as I have seen it, is over-treatment, or the insertion of the terminal too deeply which injures the rectal sphincter. The discomfort experienced depends upon the excess of trauma, which will produce edema externally and internally, and pain followed, perhaps, by ulceration. All this makes for more aftercare for

the operator and unnecessary discomfort for the patient.

It is usual for the patient to pass a few drops of blood during defecation for two or three days. The pain during defecation is negligible. Frequently defecation is easier after the first treatment than before.

The aftercare, as a rule, is simple, and such as the patient can manage himself. An ounce of mineral oil introduced with a syringe, daily, will provide all the help needed to move his bowels. Some cases do well on mineral oil orally. I have always advised against all other forms of cathartics.

Most patients do better if the anal sphincter is dilated after recovery has taken place. Occasionally, dilatation helps considerably before coagulation. This phase of the electrically coagulated hemorrhoidal case is no different from other minor rectal surgery. Spasticity of the anal sphincter should always be overcome.

Conclusion

I have limited this report to the points of difference between this method and other sclerosing methods of curing hemorrhoids. I have interpreted the result obtained as being due to sufficient destruction of the endothelial lining of the varicosity, so that the lumen is obliterated when healed. Regardless of what takes place during and following the treatment, the hemorrhoidal veins lose their abnormal distensibility and abnormal propensity to rupture, bleed, and protrude during defecation or strenuous physical exertion. The clinical results have been entirely satisfactory to recommend it to the profession.

301 W. Creighton Avenue.



Curran Pope (1866-1934)

It is with deepest sorrow that we announce the untimely departure of a beloved comrade, colleague and coworker in the field of Physical Medicine. No one was more aggressive in insisting for scientific methods in our discipline than our late friend, and no one voiced greater appreciation for the awakening of new interest for physical therapy in scientific medicine than he.

Dr. Curran Pope was born in Louisville, Kentucky, November 12th, 1866, the son of Judge Alford Thruston Pope and Mrs. Mary Tyler Pope. Educated in the Louisville public schools and Rugby private school. Graduated in medicine from the Medical Department of the University of Louisville, class of 1889. Following graduation served one year as resident physician at Kentucky Central Hospital for the Insane, after which he went to New York City to take Post-Graduate work and was private pupil of Dr. Charles A. L. Dana, famous Neurologist. Leaving New York after more than one year's training, Dr. Pope went abroad and spent two years in London, Paris, Vienna, Berlin, and Frankfort on Main preparing himself for a specialist in Nervous and Mental Diseases. He was for four years a member of the Commission for Control of the State Public Institutions.

Following his return to his home city he taught pathology in the Hospital College of Medicine and was consulting Neurologist and Lecturer at the City Hospital. Three years later he became Professor of Neurology and Mental Diseases at the Louisville Medical College, where after five years he resigned to accept the same position at the Kentucky School of Medicine, which chair he held up to the consolidation of the schools when he resigned to devote his entire time to the Hospital for Chronics and nervous cases which he and his brothers had built and which is still standing. As superintendent and head of this institution he became well known for his ability to handle those cases coming under the type he was treating and kept his hospital filled to its 35 bed capacity.

Dr. Pope was the author of a text-book on "Practical Hydrotherapy" and associate editor of many local and foreign journals, having written many hundreds of articles on Physical Therapy and Hydrotherapy.

Besides being the head of the hospital and his many other medical duties, Dr. Pope was President and Treasurer of the Pope Mining Company, which holds large fluorspar mines, very rich in the material necessary for the milling of steel.

Dr. Pope was a member of the Audubon Country Club, Bluegrass Country Club, Sleepy Hollow Club, Filson Club, a member of the Masonic Fraternity in its branches of Knight Templars, Shrine, etc. Was also an Eastern Star, and Elk.

Dr. Pope was Past-President of the Ohio Valley Medical Society, American Physical Therapy Association, Western Physical Therapy Association, and the American Congress of Physical Therapy and was one of the committee to draft the Constitution and By-Laws of the latter Association.

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EDITORIALS

STATUS OF CONGRESS IN CONTEMPORARY MEDICINE *

It is apparent to observers that this Congress has attained a position of considerable importance in contemporary medical affairs. Surprising as it may appear its membership has steadily increased, despite the depression. Its wide influence has undoubtedly been a powerful factor in establishing the value of physical therapy upon a solid basis, and impressed it upon the consciousness of the medical profession. Medical Schools are taking cognizance of the popularity of physical therapy, and hospitals of the better class are taking advantage of its offering in growing numbers. The almost universal interest in physical therapy, and the eagerness for knowledge of facts concerning it, is heartening to those who need no longer cry out in the wilderness unheard.

Noteworthy too, is the appearance in a steady stream, of scientific contributions of merit in all leading medical journals, as is the large attendance at local and national meetings devoted to the study of the subject throughout the country. This, contrasted to a time within my own memory, when any phase

of physical therapy was approached hesitatingly, or indeed apologetically. Physical therapy has now taken on a new dignity; no longer humble and thankful for crumbs; but regal in mien and commanding in stature.

Dr. Hollender, our accomplished Convention Director; Miss Smith, our Executive Secretary, and their capable associates, well deserve unstinted praise for their unselfish sacrifice of time, and also for their consistent and constructive work, which is indeed truly admirable. Without such intelligent experience Directorship of the Congress, regardless of the merits of the cause it represents, could not possibly have prospered to such a remarkable degree. The medical profession is discerning, and not to be trifled with, but it recognizes with unerring judgment, sooner or later, men and works of superior quality.

The various committees likewise deserve our thanks and appreciation for their fine work. These committees are composed of men who are eager to serve, and whose joy is achievement without fanfare. Such self-effacement is their desire, and this habit is ingrained and constant.

Our official organ, the ARCHIVES OF PHYSICAL THERAPY, X-RAY AND RADIUM, under the able Editorship of Dr. Disraeli Kobak and his associates, has set a new standard in this

* Presidential Induction Address of William L. Clark, delivered at the Thirteenth Annual Session of the American Congress of Physical Therapy, Philadelphia, September 11, 1934.

class of medical journalism, and all who critically peruse its pages must be impressed with its ever increasing excellence. We must therefore compliment Dr. Kobak and his associates, and commend them for their very successful efforts to enlighten us upon the latest and best in physical therapy.

Then, too, the active cooperation of the American Medical Association and its conservative Council on physical therapy, strengthened by capable consultants in the Sciences, designed to appraise and to censor with a critical eye, contributions upon physical therapy to the JOURNAL; correct errors of principle; expose charlatanism; to sponsor instruments of proved merit for use in physical therapeutic work, and to reject or modify those that do not meet scientific requirements. With the aid of such competent guardians, standards are being elevated and maintained, so that the cause of physical therapy will be benefited immeasurably. Those now entering the field will thus have a great advantage over the pioneers, who found it necessary to blaze their own paths without precedent to guide them.

With the addition of newer instruments to our armamentarium; the harnessing of certain of nature's forces so that they may be commanded to do our bidding; the evolution of new ideas, and the improvement of the older ones already in use, physical therapeutic remedial agents will be broadened, and the value of them enhanced to an inconceivable degree. Future generations will perhaps think commonplace what we now consider bordering on the miraculous.

From our present lofty vantage point we should all be zealous to keep abreast of progress, and to maintain our ideals, with the knowledge that we can serve well if we utilize the resources at our command, and be ever mindful of the honorable traditions of our profession. It can be said with truth that physical therapy has already taken its place on at least an equal plane beside the very best that the profession has yet offered for the relief of certain ills of humankind.

Study of the program of this Congress will reveal great breadth and balance. Essays; discussions; clinical conferences; clinics, etc., high in educational value, will be presented in profusion, and the participants in the program include illustrious physicians from all parts

of our country, and from abroad, representing various branches of the healing art. It would indeed be difficult to find a group of men whose fitness and erudition are more worthy of respect, and who can speak more authoritatively upon the subjects that they have chosen to present. That all members and guests of the Congress will enjoy and profit to the full from the intellectual treat that has been prepared, is my very sincere wish.

May the Congress fulfill its destiny to illumine our way to greater knowledge, and to bridge the gap existing in places between empiricism and scientific revelation. May it also continue to blaze the trail of progress to greater and greater heights, so that it can in truth be looked up to, rather than to ever be looked down upon. May some of the past history of physical therapy never be repeated through our own errors, weaknesses and shortcomings.

There is much more that could be said, but I shall not further encroach upon your precious time, except to say, that I shall do my utmost during my tenure of office, and at all times, to assist if possible in advancing the interests of physical therapy, and to lend my best efforts to carry out the exalted policies of the Congress, of which we, as members, are so justly proud.

SOME GENERAL ASPECTS OF THE CANCER PROBLEM

Appraisal of progress in the cancer problem is, from time to time, obviously necessary. The fact that a keener interest is now more manifest by every specialty in medicine is in itself an indication of progress, but the actual results obtained by means of our available methods of treatment more definitely disclose the present situation.

Cancer of the head and neck is being approached as one of the problems belonging primarily in the sphere of the head specialist. This is as it should be. Not infrequently the nose, accessory sinuses, ears, eyes and other parts are involved necessitating specialistic attention in addition to treatment of the malignant growth. When the use of certain physical agents becomes necessary, consultation with or continued cooperation of experts is most conducive to favorable results.

In recent years improved results in cancer management have been due to advances made in radiotherapy and in electrosurgery. Therapy

has had more of our interest than other phases of the subject probably because of the immediate results which it promises. This has not deterred the research worker who continues to plod along in an endeavor to solve the cause of cancer. Until such a time as a specific remedy is forthcoming we must content ourselves with the utilization of those procedures which time and experience have proven best in the light of our present knowledge.

When one reviews the many theories concerning the etiology of cancer and the many forms of treatment which have been suggested, one cannot help but feel that we are still groping in the dark. In spite of this, however, the clinical approach of the problem has shown good headway. The series of cases reported by Lederer of cancer involving the head and neck is an example of the amount of material available in large institutions and the results which can be obtained by intensive and rational therapy. While surgery still continues to hold a firm position in the excision of accessible neoplasms, the value of electrosurgery, radium and roentgenotherapy as important aids should not be underestimated. On the other hand it is the scientific combining of these measures which tends toward such successes are achieved.

The early diagnosis and treatment of disease in general is a modern by-word of every ethical practitioner. The significance of early diagnosis in cancer work is likewise of great import, but more significant is the plea which is now being stressed for radical management. Procrastination has resulted in numerous unfavorable end-results which might otherwise have been beneficial. In this respect Lederer sounds a keynote which in itself is a contribution to cancer management.

The question, "*is cancer curable?*" has been repeatedly raised in medical circles during the past few years. The answer, *cancer is curable* has likewise reached the ears of the profession and the laity. In some respects this question and the answer which has been given to it afford misinformation to those whose knowledge of cancer is limited. To the more enlightened it is obvious that the expounding of the question is simply a campaign of warning for early diagnosis and prompt and thorough scientific management.

THE THIRTEENTH ANNUAL MEETING

Those of our membership who have looked forward to the Thirteenth Annual Meeting of the Congress as another culmination of a year's labors and as an occasion to gather new information, renew friendships, and make new ones among kindred spirits, have not been disappointed. The very selection of Philadelphia as the place of meeting was purposeful, since whatever eastern conservatism and aloofness towards physical therapy which prevailed in that great medical center, has been favorably influenced through the activities of the Congress, so that our eastern colleagues may look forward to greater support from controlling institutional powers. The choice of the Hotel Bellevue-Stratford as our headquarters was also fortunate, since its management extended all possible courtesies to the guests, and placed at the disposal of the Congress every available facility to make its meeting a success. The large auditorium for the general sessions was provided with an amplifier, so that the natural voice of each speaker could be distinctly heard in the remotest seat of this spacious theatre.

The scientific exhibits being an initial venture, exceeded our boldest expectations. It became evident almost at a glance that the Congress had in its membership a number of earnest clinicians and research workers. Their exhibits showed prolonged, painstaking, and exact scientific investigations, both in the laboratory and in the clinic. One may say without hesitation that future exhibitors will have quite a problem, if they anticipate excelling the scientific and practical demonstrations sponsored by the Congress.

The commercial exhibits, too, differed greatly from those of preceding meetings. Many new and therapeutically valuable appliances were shown which, apart from their intrinsic value, were strongly suggestive of the fact that our manufacturers are keeping abreast of the times and in turn contributed to the more effective practice of Physical Therapy.

A special feature of the Philadelphia meeting was the presence of three guests from France and of a number of visitors from here and abroad, some of the latter wearing the emblems of official recognition and honor by their respective governments. Dr. Morel Kahn, of Paris, electroradiologist of the hospital de la

Petié, Chevalier of the Legion of Honor and wearer of the French war cross, addressed the meeting on a highly interesting subject dealing with the Lopicque current in relation to electrodiagnostics. Drs. Halphen and Auclair, representing the famous hospital founded by Baron Dr. Henri de Rothschild, whose scientific work during the late war, especially in the treatment of burns, brought him high official honors and recognition, spoke on the special value of hyperpyrexia in various forms of chronic affections. All three brought messages of good will from our sister republic. In pointing to these papers and messages we express not only appreciation to the speakers who have come from so far to render us honor, but also our gratification that in the short period of its existence the Congress has attained international reputation as an authentic source of scientific information in the domain of Physical Medicine.

The sole social event was actually an informal "get-together" dinner for many members and their families, rather than a banquet. Under the skillful and often diplomatic guidance of our distinguished President, Dr. William L. Clark, the brilliant sallies of wit and humor added zest to a variety of foods whose culinary excellence was satisfying even to our most discriminating epicureans. At any rate when the toastmaster dismissed the happy diners, there was apparent a reluctance to leave the festive board. That spoke volumes for our entente cordiale.

An achievement of moral as well as economic value, culminated at the Philadelphia meeting, redounds to the leadership and energy of Drs. Bierman and Coulter. Through their efforts the Congress now has a real registry of physical therapy technicians, the purpose of which will be to protect the good name of Physical Medicine as well as the general public against the evils emanating of questionable practices by utterly incompetent individuals. Not only will the Congress from now on have a favorable influence on the ethical cooperation of physician and aide, but initiate every measure in its power to prevent irresponsible and incompetent persons of all kinds from imposing on the public by improperly administered therapeutic modalities. Other large medical organizations have been interested and will lend their full support towards the eradication of that evil. Bierman

and Coulter are to be congratulated on the splendid work they have initiated.

The scientific program was as rich and varied as that of preceding years, yet in some respects it was somewhat different, in that the Program Committee endeavored to secure only papers with distinct messages and to prevent the presentation of topics which have not progressed since the last meeting, sufficiently, to promise more than a rehashing of known data. This in part explains why the symposium on cancer and the papers on electrosurgical resection of the prostate have been held down to the minimum of known authoritative data.

Considering that nearly every paper presented at the meeting had some message of value, we can here do no more than to point out a few of the more striking characteristics of the themes discussed in Philadelphia. Ultraviolet fluorescence as a diagnostic agent of malignant tissues was discussed from the standpoint of the surgeon and from that of the pathologist. This subject which is not generally appreciated aroused considerable interest and critical discussion. The conservative review of radiathermy as a therapeutic agent of potential possibilities in many intractable conditions, evoked much interest, because the question of short wave therapy was in the past regarded as limited to the artificial fever therapy of paretics.

In the clinical conferences, too, several papers attracted attention on account of some novel feature. Thus the treatment of hemorrhoids by a special technic of galvanolysis appeared to promise a therapeutic result superior to that attainable by classic surgery or electrosurgery. The well known disinclination of gynecologists towards the treatment of gynecic affections by physical agents or electrosurgery received quite a critical survey by the aid of demonstrations which undoubtedly has added to the list of converts, as have a number of other ably presented clinical discussions, too numerous to be given here even by title.

Finally mention must be made of the fact that the Philadelphia County Medical Society held a joint evening session with the Congress, and that two distinguished "easterners" were the orators. Dr. Hugh H. Young, of the Johns Hopkins University, addressed the combined audiences on the malignant growths of the bladder and prostate, a subject which received interesting discussion by several promi-

nent urologic surgeons. Dr. Russel L. Cecil, of Cornell University, spoke in a critical vein on the problems of arthritis, which subject is always sure to rouse the liveliest controversies, a circumstance which materialized also at the joint meeting.

The Philadelphia hospitals and teaching institutions threw wide open their doors to our members even after the Congress had been officially adjourned to reconvene next year in Kansas City. Until that hour shall arrive, we will have plenty of spiritual nourishment left us from Philadelphia. Certainly the Congress is indebted to the committees in charge of the program and of arrangements for their highly fruitful efforts in our behalf.

AWARDS OF MERIT BY THE AMERICAN CONGRESS OF PHYSICAL THERAPY FOR THE YEAR 1934

The American Congress of Physical Therapy represents a body of American physicians and surgeons dedicated to the highest attainable advancement in the research and the practice of Physical Medicine. Ever anxious to further in every ethical and legitimate way the clinical benefits of Physical Therapy as the supreme and ultimate goal of our scientific



endeavor, the Congress is desirous not only of stimulating every form of scientific research that may contribute towards the attainment of this goal, but of spiritually and materially giving expression of appreciation of outstanding labors and beneficial achievements, past and present, to the individuals meriting such recognition. The highest honor within the power of the Congress to bestow for such exceptional merit is the Gold Key, which for the past few years has been awarded to several men both here in America and in foreign lands.

The Board of Governors has unanimously bestowed this privilege on the following five men representing the United States, Great Britain, France, and Switzerland. Their names and official citations follow:

Oscar Bernhard. Distinguished Son of

Switzerland. Father of Modern Heliotherapy. His outstanding achievement is in the use of heliotherapy in Surgical Tuberculosis.

Henry Bordier. Distinguished Son of France. Professor of Medicine, University of Lyon. Author of *Diathermie et Diathermie Therapie*; an outstanding worker in physical therapy; a former pupil and collaborator of d'Arsonval. Bordier's outstanding achievement is in the physiology of high frequency current.

W. W. Coblentz. Distinguished Son of District of Columbia. Connected with the Bureau of Standards, Washington, D. C., and a member of the Council on Physical Therapy, American Medical Association. For meritorious service to medical science in the field of ultraviolet radiation.

Le Roy Watkins Hubbard. Distinguished Son of Georgia and New York. Director, Extension, Georgia Warm Springs Foundation. His outstanding work is in Poliomyelitis.

Franz Nagelschmidt. Distinguished Son of Germany, now of London and formerly of Berlin. For his pioneer work and contributions to the clinical use of diathermy in medicine.

AWARDS FOR SCIENTIFIC EXHIBITS

At the Thirteenth Annual Convention of the American Congress of Physical Therapy, the Board of Governors initiated for this session a competitive, scientific exhibit, both in furtherance of the scientific and clinical ideals the Congress has cultivated ever since its creation and as a means of acknowledging in a tangible manner true merit of earnest endeavor in the field of Physical Medicine in general and Physical Therapy in particular.

The Jury of Awards after careful and impartial study of the merits of the scientific exhibition announced that in view of the outstanding exhibits, instead of the original plan as announced, the awards should be made in three groups: Medical, Surgical, and Physiological. The winners in each group who were awarded a first prize of a gold medal and a second prize of a silver medal were:

Medical Group:

First Prize: *K. G. Hansson, M.D.*, New York.

Second Prize: *Josef Kovács, M.D.*, New York.

Surgical Group:

First Prize: *Max Thorek, M.D.*, Chicago.

Second Prize: *Grant E. Ward, M.D.*, Baltimore.

Physiological Group:

First Prize: *William Bierman, M.D.*, New York.

Second Prize: *Simon Benson, Ph.D.*, Chicago.

These awards represent an appreciation of the efforts expended and are a symbol which like a beacon should show other workers the path of scientific and clinical advance in that specialty of general therapeutics which has so greatly contributed to the relief of human suffering.

SCIENCE, NEWS, COMMENTS

C. F. Samms (1868-1934)



Late Chairman of the Board and Co-Founder of the General Electric X-Ray Corporation

It is sad news to record the untimely passing of Mr. C. F. Samms, Chairman of the Board, General Electric X-Ray Corporation, at his home in Chicago, on his 66th birthday.

In Mr. Samms' death, an interesting figure is lost to an industry closely allied with the medical and dental world, through which he contributed appreciably toward the development of many electro-medical devices, diagnostic and therapeutic.

As co-founder, with Mr. J. B. Wantz, of the Victor Electric Company in 1893, Mr. Samms was a pioneer in a comparatively new and highly specialized field of manufacture, which was to become his life work. Until his retirement from the Presidency of the organization a year ago, he had been active head over a period of forty years.

Mr. Samms' unwavering interest in physical therapy, dating from the very inception of the business, caused him to divert considerable of the company's talent and funds to the development of new and improved devices which have served to promote their wider use in medical practice. Men prominent in the school of physical therapy have long recognized in him a strong advocate and supporter of all legitimate measures for furthering its cause.

But not only was it a successful business career which this man sought to round out a useful life. His characteristic direction of all activities was such as to constantly reflect his consideration for each and every individual concerned.

Employees, many of whom for twenty, thirty and more years have affectionately addressed him as "C. F.," looked upon him as they would a father. They sought his counsel on all phases of life and he gladly shared the individual problems of "his boys." His approach to a solution of any problem was that of seeking the truth, determining what seemed right and fair to all concerned, and "seeing it through" on that basis. Business policies, once he had established them, he would not allow to be set aside, even when large profits were assured by so doing. Integrity was his guiding spirit.

To have had the privilege of association with him, in business or otherwise, was to know him thoroughly. As was his eulogy, so did Mr. Samms live daily, to make life richer for others.

(Reprinted from *Victor News*.)

Gamma Rays Split Apart Heavy Hydrogen Atoms

Gamma rays, the same kind of radiation used medically for the treatment of cancer, are now being employed to produce artificial disintegration of atoms of the "heavy" hydrogen isotope, deuterium. The atom breakup achieved throws new light on the composition of the newly discovered "heavyweight" kind of hydrogen.

Prof. James Chadwick and Dr. M. Goldhaber of Cambridge University report to *Nature* that by bombarding diplons (deuterium atoms which have lost an electron and become ionized) with gamma rays having energies of 2,620,000 volts they have produced ordinary lightweight hydrogen atoms, and neutrons.

Diplons are known in America as deuterons. They are much used as particles with which to bombard other substances and so cause disintegration. As ionized atoms of deuterium, diplons have twice the weight of ordinary hydrogen atoms.

Drs. Chadwick and Goldhaber indicate that to break down the diplons into their two constituent parts the bombarding gamma rays must have energies greater than the forces which normally hold the particles together. This condition is satisfied with gamma rays of 2,620,000 electron-volts energy.

The new discovery is expected to make pos-

sible more accurate estimates of how much a neutron weighs, a point on which various investigators differ at the present time.

A neutron is thought by some to be a composite particle consisting of an extremely close union of particles with positive and negative charges so tightly bound that there is no measurable external electric field. It weighs as much as a hydrogen atom but is much more tiny, and hence more penetrating when it strikes some other substance. So piercing is a neutron that it is difficult to distinguish between it and the packets of radiation called photons. — *Science News Letter*, August 25, 1934.

Animal Hospitals Now Use Modern X-Ray Methods

X-ray examinations and surgical attention such as are now standard in the treatment of human hospital cases should be available for sick animals also, Dr. Alois Pommer, Viennese veterinarian, told the Twelfth International Veterinary Congress at its New York meeting last week. He added that medical treatment of animals is hindered in many cases by lack of x-ray apparatus and roentgenologists giving their full attention to veterinary work. Vienna's Veterinary College has established a central Roentgen institute, which aids the practitioners in animal surgery, internal medicine and obstetrics.

An increasing use of anesthetics and aseptic surgery has occurred in Great Britain's veterinary work, Sir Frederick Hobday, principal of London's Royal Veterinary College, reported. Animals are being given anesthetics as a customary procedure, chloroform being used on horses, cows and mature dogs, while puppies and cats are usually given ether or mixtures of chloroform and ether. There has been research on comparatively new anesthetics, avertin and nembutol.

In the United States, also, Dr. W. F. Guard of Ohio State's College of Veterinary Medicine reported, there has been marked improvement in the use of anesthetics and surgery. Great advances have been made in the general application of local anesthetics to all species of animals. — *Science News Letter*, August 25, 1934.

Liver Extract Conquers Tropical Sprue

Liver, already the salvation of those suffering from pernicious anemia, promises to conquer a troublesome and chronic ill of the tropics, called sprue. Drs. C. P. Rhoads and D. K. Miller of New York City have produced clinical cures of four cases of sprue which did not respond to the treatment that previously was considered standard. They injected liver extract into the veins or into the muscles.

Sprue is a chronic disease marked by sore mouth, with a raw-looking tongue and gastrointestinal effects. It occurs mostly in hot countries and causes emaciation, anemia and frequently death. The liver is known to diminish in size.

The four cases benefited by liver extract were developed in Puerto Rico or China.

In their report to the American Medical Association, Drs. Rhoads and Miller explain that sprue requires more intensive treatment with liver extract than does pernicious anemia. Thanks to the researches of Drs. G. R. Minot and W. P. Murphy of Boston in 1925, it was found that liver is specifically effective in the cure of pernicious anemia. Liver was first used in 1927 to treat sprue by Drs. A. L. Bloomfield and H. A. Wyckoff in California. Other work by Dr. W. B. Castle and his associates of Harvard Medical School revealed the relationship of diet, vitamin B, gastric secretion and absorption within the body.

The contribution by Drs. Rhoads and Miller is the demonstration that relatively large amounts of liver extract must be injected into the muscles or into the veins so that this material, which is lacking in the patient's body, may be immediately available. — *Science News Letter*, August 25, 1934.

New X-Ray Method Makes Quick Analyses Possible

By holding a piece of metal up to a beam of x-rays it is now possible to tell quickly what are its chemical constituents. This is the seemingly magical method of analyzing metallic substances announced by Dr. L. V. Hamos of Stockholm.

The Swedish investigator has already built himself metallic "sandwiches" consisting of paper-like strips of metal piled one on top of the other. By shining x-rays at the laminated edge of the metal "Sandwich" Dr. Hamos has been able to tell what kind of metal was used for each layer. In some cases the edge of the metal strips was only 1/250 of an inch thick.

Reporting his new method of chemical analysis to *Nature*, Dr. Hamos explains that when the initial beam of x-rays (all of the same wavelength) strikes the laminated edge it produces secondary x-rays, which come off from each of the various kinds of metal illuminated by the primary beam. These secondary x-rays are characteristic for each different kind of metal known, so that if the "fingerprint rays" could be sorted out in some fashion a chemical identification is possible.

The apparatus for analyzing the tell-tale secondary x-rays consist of a crystal of pure salt shaped into the form of a cylinder. This cylinder does for the mixed-up secondary x-rays what an ordinary prism of glass or a spectrum grating does for white light — it breaks it up into its colors, or wavelengths.

As the x-rays come from the salt crystal they strike a photographic plate at different places and leave marks which distinguish each metal present in the original sample of metal.

Dr. Hamos is carrying out his research in the Riksmuseets Mineralogiska Avdelning in Stockholm. His method is adapted for the rapid analysis of metals and metallic ores where the sample's appearance must not be changed. — *Science News Letter*, August 25, 1934.

Homo Sapiens May Be Ten Million Years Old

Homo Sapiens or man as we know him has lived longer on the face of the earth than science has hitherto supposed. He rose from among the other primates toward the geologic age known as Miocene. This makes him some 10,000,000 years old.

Discussion on man's place among the primates presented to the International Congress of Anthropological and Ethnological Sciences in London indicate that scientific opinion based on new facts and researches tends to the acceptance of these ideas.

The Oxford anatomist, Prof. W. Le Gros Clark, emphasized the paramount importance of American research on the anatomy of the foot and explained that Dr. Dudley J. Morton of the College of Physicians and Surgeons, Columbia University, New York, finds in the structure of the foot the strong suggestion that the human stock diverged from the anthropoid line of evolution when the common ancestors of man and other primates were little larger than the modern gibbon, a relatively small animal to be seen in most zoological gardens and belonging to the same Simiidae family as the chimpanzee, gorilla and orangutan.

The Neandertal man, whose remains have been found plentifully in Europe, is no longer regarded as intermediate in evolution from the troglodyte apes, and man's resemblance to the gorilla is not attributed to the accident of parallel evolution upward from a remote common ancestor.

Of great interest to those who are attempting to puzzle out man's origin, is the espousal by Sir G. Elliot Smith, the British authority, of Dr. J. S. B. Leakey's conclusion that the anthropoids branched from the parent stem as early as the Oligocene epoch, the geologic time preceding the Miocene. Dr. Leakey has investigated extensively fossil beds abounding in animal remains near the shores of Lake Victoria in Kenya, East

Africa, and he offered his discoveries, Kanam and Kanjera men, as very early types of humans.

Dr. William K. Gregory of the American Museum of Natural History joined with Prof. G. Pinkley of London University in putting the Wadjak man, discovered in Java in 1889, into a new niche in human pre-history. This human type is known from a few fossils collected by Dr. Eugene Dubois, also "father" of the famous Pithecanthropus ape-man of Java. Dr. Dubois considered Wadjak man as a forerunner of the modern aboriginal Australians; but Prof. Pinkley concluded from a study of the teeth that Wadjak man, instead, foreshadows the Mediterranean type of man, who has played a much more important part in the world as we know it today. — *Science News Letter*, Aug. 11, 1934.

Fertility Vitamin E Absorbs Ultraviolet Rays

Hope, long-held, that the fertility vitamin E would absorb light in a distinct, characteristic fashion and thus make possible a positive identification appears to have been achieved by workers at the Dunn Nutritional Laboratory of the University of Cambridge. Report to *Nature*, Drs. A. J. P. Martin, T. Moore, Marion Schmidt and F. P. Bowden describe experiments on the spectrum analysis of vitamin E.

By dissolving vitamin E, prepared from wheat seed germs, in alcohol the British workers found that a sharp absorption occurred at the wavelength 2900 Angstroms when they shone light through it. This wavelength is in the invisible ultraviolet region, near the actinic rays which produce sunburn.

The key test in the research was to show that the vitamin E which produced this characteristic absorption really produced a biological effect when given to experimental animals. Such an effect was found, say the investigators, "for the vitamin caused a female rat which had shown characteristic resorption gestation to produce a litter of eight live young." — *Science News Letter*, August 25, 1934.



THE STUDENT'S LIBRARY

ANNALS OF ROENTGENOLOGY. A Series of Monographic Atlases. Edited by *James T. Case*, M.D., Professor of Roentgenology, Northwestern University Medical School, Chicago. Volume Sixteen. Foreign Bodies in Air and Food Passages. By *Chevalier Jackson*, M.D., and *Chevalier L. Jackson*, M. D. Cloth. Pp. 265. Illustrated. Price, \$12.00. New York: Paul B. Hoeber, Inc., 1933.

The editor's preface contains the following statement: "The scope of the roentgenologist's judgment is measured by the experience he can fall back upon. It is to supply a diagnostic guide rich in the fruit of experience of leading authorities in special fields of x-ray diagnosis that the editor and the publisher have conceived the production of this series of monographic atlases, to bring to the roentgenologist at home a post-graduate course from the very men whom he would seek in personal visit, and to leave with him an invaluable series of master roentgenograms which he may study and with which he may make comparisons as often as desired." This, in brief, tells the story about the volume under consideration. Nowadays when nearly every large community boasts of a competent bronchoscopist, the need for further training and study is especially obvious. The Jacksons need no introduction to the medical profession, and this masterpiece of theirs speaks for itself to those who have any familiarity with the subject. The work is based on a clinical experience of more than 3,000 cases of foreign bodies in the air and food passages. Clinical facts rather than theories are presented. The statements made by the authors are based altogether on their clinical evidence, thus offering a substantial and factual support which goes unquestioned. The reproduction of the films is an excellent piece of clinical photography. It is doubtful whether a more comprehensive volume is available in any language. Certainly for the student of bronchoscopy and esophagoscopy, the information presented should prove so valuable that repeated study and reference are bound to be of indispensable aid.

BEFORE THE DAWN. By *John Taine* (Eric Temple Bell), Professor of Mathematics, California Institute of Technology; Member National Academy of Science; Past President Mathematical Society of America. Cloth. Pp. 247. Price, \$2.00. Baltimore: The Williams & Wilkins Company. 1934.

Here is a book which contains the power to release the tired reader from momentary worries, responsibilities and the dull realities of life, and transport him into a sphere of romance and adventure that quicken the pulse, add new zest to life, and momentarily raise his blood pressure. Like his famous predecessor, Carrol of "Alice in Wonderland" fame, John Taine, or rather Professor Eric Temple Bell, is also a mathematician by vocation, whose

scholastic reputation bids fair to be submerged by his more popular talents as a writer of fascinating romance. It is the story of one of the momentous transitional periods of life on earth, when the great saurian was king and the insignificant mammal began to adapt itself to an undreamt of destiny. By means of a vivid style and a fertile imagination, Taine has created a structure as tenuous as dreams and yet as solid as reality in which fantasy and science become so intimately mixed as to give birth to a new type of fiction called *fantascience*. This fictitious realism has been picturesquely defined by the author, himself, "as a literary fabric having a thoroughly scientific warp, but a fictitious weft, or as a literary edifice whose foundation stones are facts and the superstructure, fiction." The kernel of the plot is the perfection of a television, which enables the characters in the story to project themselves toward the past, into the dim recesses of the earth's early period, a period which abounded with saurian life so grotesque, gigantic and ferocious as to reduce our contemporary monarchs of the carnivora into a stunted, anemic variety — *declassé* and decadent. The story is so realistic and fascinating that one is unconsciously transported on the very wings of fantasy and science to a realm of life from whose loins arose the most sublime and moronic animal, the so-called *homo sapiens*. As a tribute to the author's talents, the reviewer confesses a most thrilling night, the story holding him so tightly bound that he relinquished it only when the last page was read, and a new day was dawning. We have discovered in *fantascience* the supreme tonic for a jaded mentality.

BLOOD PICTURES. An Introduction to Clinical Hematology. By *Cecil Price-Jones*, M.B. (Lond.) Cloth. Pp. 73, with 5 colored plates and 7 illustrations in text. Price, \$2.40. Baltimore: William Wood & Company. 1933.

This brochure has the virtues of brevity, conciseness, and clarity. It describes the blood picture in normal and diseased states and is intended as a practical aid to laboratory workers, students and clinicians in their daily medical problems. The present edition is the third and has been revised to incorporate the advances in hematological knowledge and the newer methods of interpretation of blood examinations since the previous edition. The work is rounded out into two parts and an appendix, the latter offering a phylogenetic diagram of blood cells, the former sections presenting the technic and description for (1) methods of collecting and examining of material, and (2) the blood pictures in the diagnosis of disease of a bacterial, protozoal, blood and malignant nature. The colored plates accompanying the various discussions artistically illustrate the author's thesis. This work is one of the most rational contributions to medical practice.

VITALISM AND MECHANISM. A Discussion Between *Herbert V. Neal*, Ph.D., Sc.D., Professor of Zoology and Dean in Tufts College and *James F. Porter*. Cloth. Price, 50 Cents. Pp. 87. Published by the Authors. 1934.

This book though small in size has that stimulating quality designated as provocative. It provides a well rounded discussion on vitalism and mechanism in a strictly informal manner. Indeed, the text is made up of a series of letters supposedly exchanged between two highly educated individuals who though maintaining opposite views, show an affectionate disposition toward each other. There is a sweet informality to this discussion that removes the edge of its polemic quality and tends to arouse wider interest in a subject that has heretofore only received consideration from specialistic thinkers. Undoubtedly we are all interested in our Cosmos and the manner in which it is regulated. But irrespective whether it is emerging in a purposive manner, determined or mechanistically adapted by universal laws, these philosophical theories are of interest to all serious thinking individuals. Under the guiding influence of these stimulating discussions renewed and new interest is aroused in the mechanistic and vitalistic concepts of the world we live in, and even though our friendly antagonists reach an intellectual impasse, the reader closes the last page with a feeling of satisfaction that he is the better informed by the perusal of this scintillating work.

DIE PERIODISCHE FRUCHTBARKEIT UND UNFRUCHTBARKEIT DES WEIBES. Der Weg Zur Natürlichen Gevurtenregelung. By Prof. Dr. *Herman Knaus*, Assistant at the Women's Clinic, University of Graz. Cloth. Pp. 147, with 64 illustrations and 12 tables. Price, 15 Marks. Vienna: Wilhelm Maudrich. (American Agency): Chicago Medical Book Company, Chicago). 1934.

This monograph represents a newer concept of birth control that is an entire departure from any hitherto conceived idea on this subject. The basis and argument for this original presentation centers around the following biological facts: (1) The life of the sperm following the ejaculation per coitus is of short duration — about 48 hours; (2) the life of the ovum after natural ovulation is even of shorter duration — perhaps less than 24 hours; and (3) ovulation occurs definitely fifteen days before each subsequent menstrual period. With these well established facts in mind, it remains to ascertain accurately the periodicity of the menstrual cycle by a record of data on a calendar devised by the author. By means of this calendar the individual records the date of onset of each menstrual period and the length of the cycle. Over the course of many menstrual periods one can readily note the regularity of the menstrual period. The date of ovulation is expected fifteen days before each coming period. This date represents the only time in the menstrual cycle that the woman can conceive. By sexual abstinence for a short period of time, namely, two days before, and for one day after the expected date of ovulation pregnancy can be avoided. This period of sexual abstinence can be slightly extended if there is any tendency to irregularity of the

menstrual cycle, thereby assuming more safety in timing the date of ovulation. This work is logically presented and the data appears scientific. It may yet answer the religious objections of some people to mechanical and chemical means of contraception. The author includes a pamphlet of a menstrual calendar which includes a short description of its importance and a method of its use. Professor Knaus advises that patients interested in this method of birth control furnish the required information for this calendar for about one year, also a record of such other events as abortions, pregnancies, date of labor, and a short record of subsequent menstrual periods. While the theory that the menstrual cycle consists potentially of a short period of fertility and of a much longer period of sterility appears plausible, its practical application needs more confirmation.

THE MEDICAL AND ORTHOPAEDIC MANAGEMENT OF CHRONIC ARTHRITIS. By *Ralph Pemberton*, M.S., M.D., F.A.C.P., and *Robert B. Osgood*, A.B., M.D., F.A.C.S. Cloth. Price, \$5.00. Pp. 403 with illustrations. New York: The Macmillan Company. 1934.

Few affections have such a varied etiology and greater morbidity than chronic arthritis, and none overshadows it among the contemporary major social or medical problems. Chronic arthritis as pointed out by the authors is sufficiently difficult in management and important in its economic influence to deserve special evaluation and thorough exposition for the benefit of practitioners, internists and orthopedic surgeons. This book being the result of a fortunate union between two outstanding workers in their respective fields, both having devoted considerable study to this problem, contains much to recommend it to the profession. It is a work that not only offers an authoritative discussion on this important problem, but is written in such delectable rhetoric as to make its study a delightful and profitable pastime. The text is based on the authors' conviction that chronic arthritis is a preventable and curable condition and that the current knowledge of the nature of the disease and of measures necessary to combat it is not as generally understood throughout the medical profession as it should be. Of the fourteen chapters, six have been devoted to a review of its history, causes, morbid changes and symptoms. The remaining eight have been utilized to the more difficult and practical exposition of its control and management, an important consideration where the therapy has yielded such brilliant and disappointing results. The entire range of therapeutic possibilities is evaluated, classified and assigned their proper sphere of importance. As one should expect from this broad but critical evaluation, medicinal and physical therapy share in common the brunt of the management of this protean disease, with orthopedic cooperation as a necessary and even important adjuvant. There is no question that this exposition is the clearest and most compact discussion on chronic arthritis written by American authorities and promises to become the best read text on the subject. The book carries a generous reference appended after each chapter and a detailed general index.

INTERNATIONAL ABSTRACTS

Electrosurgery (Rate of Healing). Arthur H. Burgess.

The Lancet, 2:1411, (Dec. 23) 1933.

Provided that an equally rigid aseptic technic be adopted as is employed in scalpel surgery, operations performed by electrosurgical methods are attended by primary healing with a frequency at least equal to that of scalpel surgery. In the surgery of malignant disease it is generally accepted that malignant cells can be transplanted during the course of a surgical operation if cancerous tissue — either the primary growth, the secondary glands, or the numerous "permeated" lymphatic channels between these — be traversed by a scalpel which passes thence into healthy tissues; many local recurrences are thus explicable. If, however, the scalpel be replaced by the fine high frequency electrode the intense heat generated at point of contact will suffice to destroy any such liberated cells and prevent their local transplantation, while the divided lymph and blood capillaries are immediately sealed and further avenues of dissemination effectively closed. So obvious is the superiority of the high frequency electrode over the scalpel in this respect that it is now generally recognized as the safer instrument in the surgery of all malignant disease. The same may be said of its employment during "biopsy" upon any tumor suspected of malignancy, or where incisions have to be made into, or close to the seat of bacterial infection.

In the surgery of non-malignant and non-infected conditions, we are upon more debatable ground. In comparison with scalpel surgery electrosection has certain definite advantages, foremost of these is the lesser amount of after-pain not only in the immediate postoperative period, but throughout the whole course of wound healing.

Shock is definitely lessened with electrosection, partly from the diminished afferent impulses due to the sealing up of divided nerve fibers, partly from the slight diminution in hemorrhage, and partly from the increased temperature of the severed tissues. The sealing of blood vessels by running the current along an artery forceps temporarily applied thereto, may lead to a considerable saving not only in time, but will be conducive to better healing. The intense heat developed at the site of the wound will make it aseptic and healing more rapid; less scar tissue is formed and the resultant scar is softer and more pliable and has less tendency to contract.

The disadvantages of electrosurgery are that high frequency machines of sufficient power to prove effective in all branches of surgical work are cumbersome and difficult of transport, and at present are undoubtedly expensive initially

though not in their running costs. Some considerable period in training is required for their effective use since a very different touch is needed than for scalpel surgery. Also, ether, acteylene, or other similar explosive anesthetic cannot be employed in operations upon the head or neck.

Undoubtedly the most important indication for electrosurgery is to replace the scalpel in operations for the removal of malignant growths, whether of the skin or of the deeper tissues or organs; here by sealing off divided lymphatic vessels and destroying exposed cancer cells, it minimizes the chances of local recurrence.

Operative Treatment of Retinal Detachment With Electrocoagulation. Arnold Knapp.

Arch. Ophthal., 6:733, (Dec.) 1933.

Diathermy is used to produce coagulation of tissues. This is accomplished by the application of needle electrodes to the eyeball at the site of the tear. With careful dosage the needle perforates the sclera and the choroid, and a circumscribed area of the choroid is coagulated. The subretinal fluid then escapes through the punctured hole, and the retina becomes attached to the coagulated choroid and, in favorable cases, adheres. The vitreous is shut off from the subretinal fluid by the seclusion of the hole, that is, by the adhesion of the retina to the choroid in an area surrounding the tear. The needle electrodes vary in size and thickness. Weve uses long thin needles to puncture the retina at the margin of the tear; with the ophthalmoscope he observes the effect of his operation. Safar's needles are only 1.5 mm. in length in order to prevent too deep penetration. The needle punctures are made about 2 mm. apart, and their number depends on the retinal condition that is present and the object to be achieved. Adhesive choroiditis can be produced with a mild current. A current of low intensity of not more than 30 ma. to each needle is used; the needle perforates the sclera quickly and without force. As soon as the perforation takes place, the needle is promptly withdrawn or the current is shut off and the needle is left *in situ*. The proper dose is extremely important. With a too large or a too strong dose the coagulated tissues continue to be heated and approach burning, whereby certain advantages of coagulation such as a soft scar are lost. Too heavy doses damage the retina and produce opacities of the vitreous and injury to the macula. The older the retinal detachment the more friable is the retina and the greater is the danger of secondary tears following the operation. While hemorrhage in the vitreous also occurs with diathermy, they are much

less frequent than with ignipuncture. After diathermy, white coagulated areas are seen with the ophthalmoscope; then grayish - white dotted cloudy areas with a grayish reflex like a fresh choroiditis are noted; gradually after two or three weeks, the individual puncture areas appear, pigment develops and the picture of an old choroiditis is presented.

Proper indications for operation must be present. The most important indication is that the retina should be capable of being unraveled or replaced; it is also essential that no bands or folds be present and that the retina should not be shrunken; in other words, that none of the changes in the detached retina which come with age should have occurred. The color of the detached retina gives valuable information. The vitreous must not be disorganized and the tension of the eyeball not markedly reduced. This holds true particularly for aphacic cases. An important step is the examination for holes and tears and the determination of their number and position. The principles laid down by Gonin and Amsler will be found of great value. This examination may require considerable time, but the discovery of the tear and its localization often mark the difference between success and failure. In cases in which no hole in the retina is found, operations have nevertheless been performed, and with some, although a smaller percentage of, success. In these cases the presumptive site of the beginning of the detachment is attacked.

Alternating Current in Medical Practice. F. L. Pearl.

Brit. M. J., 3805; 1081, (Dec. 9) 1933.

The alternating current is, when all the evidence has been taken into consideration, definitely more dangerous to life than direct current. The home office statistics are strongly in favor of this point of view. Dr. F. L. Pearl says that recent experiments on rats have not confirmed the belief that alternating currents are three or four times as dangerous as direct, but points out that the rat recovers spontaneously from ventricular fibrillation and that mortality statistics vary with different experimental animals. In certain experiments, he says, alternating current has proved more apt to produce hemorrhage, but the direct current was more destructive to nerve cells, inducing an intenser nervous inhibition and setting up cardiac fibrillation in a much shorter time. It is, however, wise to play for safety and regard the alternating current and any leak from wires carrying it as an additional source of danger. Therefore, leads into apparatus made of metal should be regularly overhauled and renewed and adequately earthed. Indeed, it would be better in all hospitals and nursing homes to replace metal shock-cradles and bedside lamps with types in which the whole stand is made, as far as possible, of non-conducting material.

The treatment of electric shock is likely to concern the general practitioner progressively more than it has done in the past. Any person

unconscious from shock, according to Dr. Pearl, is suffering either from ventricular fibrillation, or from failure of the respiratory center, or from both. Respiratory failure can often be combated by the Schaefer method of artificial respiration, which must be begun as soon as possible and continued even in the face of apparent failure. Jelinek went so far as to say that no patient was ever killed by electricity, but only by asphyxia. Pearl's experience, however, has been that in most cases artificial respiration has been useless, even when properly given; no amount of it, he pointed out, will cure a fibrillating ventricle. Nevertheless, it is not easy to distinguish the cause of the failure of respiration in a given case, and Jex-Blake advises the rescuer to continue artificial respiration until the body cools or rigor mortis sets in. Nothing seems to help ventricular fibrillation but direct massage, a remedy too heroic for most general practitioners; but dogs have been revived by the injection of potassium, followed by calcium, into the carotid, and this might be worth trying if the diagnosis is certain, for spontaneous recovery is practically unknown. This provides an interesting and not unimportant problem for the biochemist; to devise a simple means of injection, capable of being applied by the well-trained first-aid men in big electrical generating stations, who are always first on the field. Electric burns may become serious from toxic absorption, hemorrhage or infection, and should be treated carefully. These are not likely to be caused by the domestic current, though with the extension of the grid medical practitioners should be warned against installing x-ray apparatus for diagnostic purposes without acquainting themselves with the danger of burns to themselves and their patients.

Short Wave Treatment — Physical and Technical Considerations. J. Kowarschik.

Der Balneologe, 2, 1934.

Short wave therapy is given with a high frequency current of 10 to 100 million alternations a second, that is about 30 to 3 meters wave length (Wave length times alternation figure always equals 300 million, as all electric waves travel with the speed of light, 300 million meters per second). Waves under 15 meters are also called ultrashort waves. Whereas the radio senders use the electromagnetic waves from high frequency current, which are sent out from antennae into the ether, medicine uses the high frequency current itself, in closed alternating arcs. The current is passed into the body by means of electrodes touching it, or the electrodes are separated from the body by a sheet of air (condenser field treatment or treatment in the electric field according to Schliephake).

Short wave current can be produced with spark gaps or with electron tubes (transmitting valve). The spark current is damped, that is, it consists of separate groups of rapidly sinking oscillations with relatively long oscillation-free intervals. It is a mixture of oscillations of various

wave lengths. The electron tube on the other hand produces continuous oscillations that run on without pause, of uniform wave length. Apparatuses that have only one tube, because of their working in one direction, can only use one of the half waves of the commercial alternating current, their high frequency current therefore has pauses too, corresponding to the unused half wave. There are tube apparatuses which are set for one wave length only, and those which can be set for two or three separate wave lengths, but none which can be set for any desired wave length. Whereas the tube apparatus is essential for the experimenter, for therapeutic practice, the spark apparatus is sufficient. Probably no certain wave length is necessary for treatment, but a certain wave band, such as is necessary in light-, Röntgen- or radium-therapy.

When the growth of a bacterial culture is retarded or stimulated with a certain wave length in the electric field, this is not necessarily caused by the wave length; the strength of the field and the amount of energy absorbed by the culture is just as important. Besides, bacteria often react entirely differently in the body than in the culture. A wave specificity is certainly possible, but not yet proved clinically. One can only say that the peculiar effectiveness of the short wave therapy, which distinguishes it from diathermy, particularly the effect on infectious diseases, is first of all due to the ultrashort waves, whereas waves over 15 m. seem only to be effective thermally.

Short wave apparatuses should not only be judged by their qualitative but also by their quantitative achievement. This decreases rapidly with the decrease in wave length. The 3 meter wave is today the shortest that may possibly still have therapeutic effect. The thermal effect of the ordinary diathermy apparatus is greater than that of the short wave apparatuses, moreover, its current is capable of objective dosage, whereas we are entirely dependent upon subjective sensibility in dosing the short wave current. It is possible to kill mice, frogs, and such, in a short time in the condenser field, due to overheating; but if the field is enlarged, as is necessary in the treatment of the human body, the thermal effect sinks extraordinarily. In the same degree, the specific effect sinks also, of course.

It is not a matter of indifference how one applies the short wave current. A definitely greater deep effect than with diathermy is only attained in the condenser field under the condition that the electrodes are at a great enough distance from the body. If one uses electrodes insulated with hard-soft rubber, felt, and such-like materials, and if these are applied directly to the body, the deep effect is lost right there. Only the skin and the subcutaneous tissue is warmed, the warming of the deeper parts is entirely insufficient, as proved by experiments on corpses performed by the author. The short wave treatment with rubber-insulated electrodes touching the body is decidedly less effective than diathermy. Conditions are entirely unsatisfactory when the electrodes

are applied over the clothing. If one uses bright metal electrodes, and lays these directly onto the skin, the effect is somewhat better in the deep parts than with diathermy. Schliephake himself pointed out that even in the condenser field, the deep effect disappears at once, if the condenser plates are brought too close to the body. There is then, as with use of condenser electrodes, too great a surface warming, and an insufficient warming in the deep parts. With sufficient air distance, a very great difference of potential is produced by the high capacity resistance, in comparison to which the resistance of the body is insignificant (Schliephake). If today, electrodes are usually used applied directly to the body, and not distanced with air, that is because most of the short wave apparatuses are of insufficient power, and therefore not strong enough to overcome high air resistance. — *Ars Medici*, 12:303, (July) 1934.

Alternating Current in Medical Practice. W. J. Turrell.

Brit. M. J., 3806; 1138, (Dec. 16), 1933. [Correspondence Section.]

Sir: — The leading article in the *Journal of December 9th* (p. 1081) on alternating current in medical practice is a very timely one in view of the increasing distribution of these currents and their employment for so many purposes.

It has for a long time been recognized that the alternating are far more dangerous than the direct currents; but the reason for the increased danger associated with their employment does not generally appear to be recognized. The explanation is to be found in the relative velocity of the hydrogen ion, a relative velocity which is also the main fundamental principle governing electrotherapy. When an electric current is established the hydrogen ion — possessing a velocity greater than any other ion conveying the current from the positive to the negative pole — causes a momentary concentration of hydrogen ions at the negative pole and so causes an electrochemical action of an acid character, which excites the nerves and other tissues in its neighborhood. At the abrupt break of the current, again owing to its relatively high velocity, the hydrogen ion rushes away from the point from which it is proceeding — namely, the positive pole — and so causes a brief relative excess of hydrogen ions in this region, which excites the nerves in the neighborhood of the positive pole by an electrochemical stimulation of an alkaline character.

When administering electrical current, or when taking electrical reactions, we employ a very low voltage, and the reaction is weak and is confined to the neighborhood of the active electrode. But when a person is brought into contact with a high tension wire, a high voltage current passes through him to earth, pervading his whole body and in its path stimulating the vague nerve, and this results in the inhibition of respiration and

the heart's action. This may prove to be a fatal "electric shock."

Now when an alternating current is employed at the usual periodicity of 50 per second, this will result in 200 shocks per second — namely, a make-and-break shock in one direction, followed by a make-and-break shock in the alternating direction, at each cycle of the current. On the other hand, in the case of the direct current an "electric shock" would only occur when the current was made and when it was broken. In the interval between make and break the only danger from the direct current would arise from the overheating of the tissues, which would be greater than from the alternating current, due to the high amperage of the passing current. Apart from this heating effect the constant current, as d'Arsonval has stated is only dangerous at make and break. On these grounds it is not difficult to visualize the far greater danger of "electric shock" from alternating than from direct currents.

It would appear that, in the case of high tension shocks, inhibition precedes fibrillation of the cardiac muscle, and if the high tension voltage is sufficiently high, apparent death from failure of respiration will occur before fibrillation is established. This is a very important point in relation to the treatment of "electric shock"; it is perhaps best shown by the early experience of electrocution in the United States. Electrocution was introduced into New York State in 1890. At first a voltage of 1,500, with a periodicity of 15 to 30 was employed. It was found that, though respiration was inhibited and sensibility abolished almost immediately, yet the heart continued to beat, and, when additional shocks were not administered, respiration was in some cases restored. Therefore, in order to avoid these disconcerting recoveries, a new technic was adopted in 1899. A current of 1,500 to 2,000 volts was applied for seven seconds, then a current of 200 to 400 volts for thirty seconds, and finally a current of 200 volts for a few seconds. In this way a respiratory inhibition was primarily secured, and was followed by a fibrillation of the ventricles, due to the lower tension, and thus a fatal result was ensured. In two cases an immediate necropsy was performed, and revealed to view a rhythmical contraction of the auricles with the ventricles in a state of fibrillation.

Of special interest to electrotherapists is the fact that fibrillation may be set up by currents of quite low voltage if the cardiac area lies in the path of the current. Deaths from this cause are said to have occurred in Germany even from the low voltage currents derived from the pantostats. D'Halluin, owing to the almost certain fatal termination of fibrillation, goes so far as to state that we arrive at the paradox that currents of moderate or even low voltage may be even more dangerous than those of very high tension. Fibrillation ensuing from the use of alternating currents is clearly due to direct elec-

trical stimulation causing arrhythmia of the cardiac muscles; but the fibrillation which some observers have recorded as resulting from the direct current would appear to be secondary to the heating action of the very high amperage which is necessary for their production. Prevost and Batelli needed a direct current of 500 volts for the production of fibrillation.

Electrotherapists may employ the very valuable alternating currents of low frequency with absolute safety provided the lines of force of the current do not pass through the cardiac area — that is to say that the current may be passed from foot to foot or leg to leg, but not from hand to hand or arm to arm. The risk of the latter arrangement is evidently very remote, for such a technic is daily employed, and, so far as I know, no untoward results have been recorded in this country. But a theoretical and remote risk would appear to exist which can be entirely overcome by employing four in place of two electrodes, and connecting the upper electrodes on the arms or shoulders to one terminal of the apparatus and the two lower electrodes on the hands or forearms to the other terminal. In this way the lines of force of the current are confined to the arms, and do not pervade the cardiac area. Alternating currents of a tension as low as 10 volts can set up fibrillation in a dog's heart.

There appears at present to be no practical treatment of cardiac fibrillation; the treatment suggested by D'Halluin of the intravenous injection of potassium is quite unpracticable as an emergency measure. The dosage of the potassium has to be accurately adjusted to the body weight or to the cardiac volume, and it has to be very slowly injected, or it may be fatal even though the dose is not excessive. All authorities are agreed that the treatment of "electric shock" is by immediate and prolonged artificial respiration. Jelinek has shown that death from a high voltage shock is at first only apparent, and that life can often be restored by immediate artificial respiration, and this view is confirmed by the revivals which occurred in the early electrocutions in America. But it cannot be too strongly emphasized that it must be commenced at once and continued for a considerable time. "Recovery is common after three hours, and has occurred after eight hours." (Lancet, June 2nd, 1928.) Whatever other measures may be adopted they should not be such as would interfere with the performance of artificial respiration. Many lives have probably been lost by not adopting this simple procedure at once and by delaying this treatment until the patient has been transported to hospital. With the police, firemen, railwaymen and so many others trained in artificial respiration there can be no excuse today for this fatal delay. All those employed in the generation, supply, or employment of high tension electricity should be thoroughly trained and periodically examined in the efficient performance of artificial respiration.

INTRANASAL ZINC IONIZATION — ITS FUNDAMENTAL ASPECTS AND CLINICAL VALUE *

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The successful treatment of aural and general surface sepsis with zinc ionization has suggested its potentialities in rhinologic practice. For the past ten years the medical literature has dealt rather liberally with this method, the consensus of opinion being sufficiently favorable to warrant a review of its fundamental and clinical aspects.

For intranasal treatment the galvanic current early was utilized for zinc electrolysis of the inferior turbinates. Recently Norrie⁽¹⁾ revived this treatment and claimed for it good results in reducing the size of the turbinate bodies. The galvanic current in the treatment of nasal hydrorrhea is mentioned by St. Clair Thomson⁽²⁾ in his text book, the source of his information being an article published by Cresswell Baber in 1898.

Intranasal zinc ionization has been employed by Fox⁽³⁾ for the postoperative treatment of the maxillary antrum, and by Hollender and Cottle⁽⁴⁾ for chronic rhinitis. Harris⁽⁵⁾, Feldman⁽⁶⁾, Gale,⁽⁷⁾ Smith,⁽⁸⁾ Cahill,⁽⁹⁾ McCoy,⁽¹⁰⁾ Sputh,⁽¹¹⁾ McCurdy,⁽¹²⁾ and others have at one time or other reported on the use of zinc ionization in some forms of rhinitis and sinusitis.

Demetriades,⁽¹³⁾ and Franklin,⁽¹⁴⁾ have used this therapy in hay fever of the seasonal and perennial types, and Warwick⁽¹⁵⁾ only recently presented a paper dealing with its use in similar conditions.

Fundamental Aspects

The two fundamental laws upon which ionization is based are known as those of Faraday's, viz.:

1. The amount of any one substance liberated is proportional to the quantity of electricity which has traversed the cell (tissue between the electrodes).

2. Chemically equivalent quantities of ions are liberated by the passage of equal quantities of electricity.

Fabre Palaprat⁽¹⁶⁾ in 1883, and later Stephane Leduc,⁽¹⁷⁾ and Lewis Jones⁽¹⁸⁾ investigated the possibilities of ionization with

certain drugs and metals. While these authors presented no specific definition and withheld their views of the underlying basic principles, later writers freely expressed their opinions. One of these sources defines ionization as an arrangement by which a galvanic current is conducted to a body surface through suitable electrodes saturated with solutions of drugs or soluble metals. The "ions" are stated to be the result of decomposition of the substances in solution, and being electrically charged, they are capable of a superficial penetrating action in some of the body tissues, more particularly the mucous membranes.

There is a distinct difference in the present understanding of electrolysis and ionization as compared with that held by the older writers. In this connection Friel⁽¹⁹⁾ has pointed out that "by electrolysis in medical work we usually mean the changes which take place when a needle attached to one of the terminals of an electric battery is inserted in the tissues; and by ionization, the introduction into the tissues of one or other of the radicles of a salt dissolved in water."

Zinc sulphate, when dissolved in water changes to metallic zinc and SO_4 . The extent of the dissociation depends upon the dilution. For intranasal ionization, Friel's formula has been found best to meet the requirements. This consists of zinc sulphate 5 gms., glycerin 60 cc., and water to make 1,000 cc. For treatment this solution is diluted with an equal amount of warm water.

The amount of absorption of ions is proportionate to the strength of the current. In order to secure maximum effects, the current strength should be up to comfortable tolerance (usually about 10 ma.) and for a minimum application of 15 minutes. Recent observations have shown that an increased action results from longer treatment and maximum current, as against a fixed current strength and an arbitrary treatment period.

Therapeutic Effects

It is unfortunate that the term "ionization" has been used so loosely and inaccurately in

* Read before the Seminar of the Department of Laryngology, Rhinology and Otology, University of Illinois College of Medicine, Chicago, October 3, 1934.

an effort to label the procedure under discussion. So many synonyms are used in the literature and are employed so interchangeably that the matter of terminology is in a state of confusion. All that can be said in justification of the general use of the term "ionization" is, that most writers have adopted it instead of a term which at once better designates the process and is all inclusive.

The numerous experiments cited by Friel,⁽²⁰⁾ Turrell,⁽²¹⁾ and others attempting to illustrate the electrical and physical phenomena involved will not be repeated here. While some of them are of interest, others are without practical application and the results are not conclusive. Contrary to the belief of years ago, it is now a matter of fundamental knowledge that the current generated by a battery of cells is one of negative electricity and that it has its source at the zinc plate. For therapeutic use, ions are classified as *anions* and *kations*, the former being introduced by the anode, the latter by the cathode. Copper and zinc belong to the kation group.

The process of ionization as now employed therapeutically must be considered as capable only of a superficial action on open surfaces and mucous membranes. The older belief that one is able to "drive in" drugs into the tissues through the skin is too fallacious for scientific consideration.

In ionization of mucous membranes tissue change is stimulated. It is quite likely that this change involves surface tissue penetration of an electrolytic substance. The depth of penetration of the various ions depends on several factors. Estimation of the quantity of an ion that will be introduced in any given period requires consideration of the electrochemical equivalent. This is the quantity, by weight, which is liberated by one ampere for one second, and this weight is in proportion to the chemical equivalents of the ions.

The action of zinc ions on the mucous membranes differs from that of the medicinal ions. In the case of the latter a soluble molecule is absorbed by the tissues, while in the former an insoluble precipitate is produced in the tissues. It is claimed that the effect of this precipitate is sterilizing or germicidal, depending upon the milliamperage or strength of the current and the duration of the flow.

During each treatment, the patient experiences a pronounced metallic taste and a profuse salivation. After the treatment one ob-

serves a greyish surface discoloration of the mucous membrane. This is probably a mild surface coagulation as the discoloration cannot be removed easily by rubbing. After the mucous secretions again become stimulated, the membrane gradually is restored to its original color. In addition to the local reaction all the symptoms of an acute coryza appear and persist for one to three days.

Technic and Apparatus

Various technics have been suggested for intranasal ionization. Friel⁽²²⁾ employed a small rubber balloon to block the post-nasal space, in order to keep the nose full of the ionizing solution and at the same time prevent it from running down the throat. This method has several disadvantages, as a result of which Campbell⁽²³⁾ introduced his technic. Although rather complicated in nature, in his hands it has operated successfully. This technic is carried out with the patient in the prone position. One nostril is plugged with plasticine and through this a Eustachian catheter insulated up to the proximal end is passed. Through the catheter the nasal chamber is filled with zinc solution, which, when flowing will escape around the posterior end of the septum into and out of the opposite side of the nose. The active electrode is attached to the non-insulated proximal portion of the catheter and the current is turned on slowly up to 10 or 15 ma.

The simplest technic and one which operates satisfactorily in any cavity has been extensively employed by me⁽²⁴⁾ for the past ten years. It consists of packing the nasal chamber with long, narrow strips of gauze well moistened with zinc solution (Friel's formula). One should be cautious in covering all surfaces by introducing the gauze firmly high up, posteriorly, and in the middle and inferior meati. Before the treatment is started the membranes should be cleansed of secretions and crusts by suction, tampons, or irrigation with the same zinc solution used to moisten the gauze packing. The negative pole which is a felt pad of about 5x7 inches may be fastened around the forearm, or preferably to the nape of the neck. The patient is placed in a reclining position, with the head somewhat lower than the rest of the body. An insulated wire with a zinc fixation electrode is attached to the wet packing and held in position by some dry cotton packed into the

meatus. This wire leads to the positive pole of a galvanic generator set or battery. Another insulated wire connects the moistened felt pad to the negative pole. With this arrangement the circuit is completed. The current is turned on very gradually and increased until the patient develops a metallic taste and profuse salivation. When the point of comfortable tolerance is reached, the current strength is maintained. If the meter indicates that the tolerance is at 10 ma. the treatment is continued for 15 minutes; if the reading shows 15 ma., the treatment is discontinued after 10 minutes. In the case of children and some adults, with a tolerance of about five milliamperes, the current should be maintained for 30 minutes. The plan is to give 150 milliamperes minutes, arrived at by multiplying the current strength in milliamperes and the minutes during which the treatment is continued. The suggested durations of treatments are rather arbitrarily based on experience, but a reasonable extension will occasionally prove of benefit. In fact, improved results were noted in many instances when the fixed treatment was even doubled.

Indications

In more than 1,000 ionization treatments during the past ten years, I have obtained good results in simple chronic rhinitis*, so-called "intumescent" or mild hypertrophic rhinitis, and in mild involvements of the anterior ethmoidal sinuses.⁽¹⁰⁾ It has also been shown to be a valuable postoperative aid,⁽²⁵⁾ especially when healing of the nasal membranes is for some reason delayed. Ionization of the antral mucosa is indicated after window resection when resolution does not occur as promptly as it should from a simple drainage. The improved results in such cases point to ionization as a definite advance in the therapy of maxillary sinus disease.⁽³⁾

Zinc ionization minimizes and frequently cures "postnasal discharge" when the source is strictly localized in the nasal mucosa. So many terms are used to designate nasal affections, the main symptom of which is "postnasal dripping," that no attempt can be made here to present detailed indications for ionization. Furthermore, the method has not yet passed the experimental stage, so far as extension of indications is concerned.

That zinc ionization is effective for shrinking polypoid tissue is supported by the experience of McCurdy.⁽¹²⁾ No claim can be made that this treatment yields permanent results, but it is advocated as a desirable temporizing measure when for some reasons surgery has to be deferred.

"Allergic Rhinitis"

Although I have employed zinc ionization in "allergic rhinitis" of the perennial type since I first attempted this physical procedure in 1923, I have never believed that in this condition it possessed more than a palliative effect. I still contend that its curative value remains to be determined. In four out of 10 patients treated by me two years ago, in three out of seven treated more than one year ago, and in nine out of a series of 15 during the current year, the symptoms of sneezing, lacrimation and stuffiness have been arrested. No supplementary therapy was given during the ionization treatments, the maximum number of which was four, and the average two, at weekly intervals. Several of the patients who responded had only a single treatment. (Table 1.)

In seasonal hay fever a lessening of the severity of symptoms is occasionally observed, providing the treatments are instituted prior to the hay fever season. In a series of 14 patients so treated during the 1933 season (summer and fall) no patient reported complete relief, but four were so relieved in comparison with previous years, that they found it unnecessary to use other palliative means. When, however, ionization was carried out during the acute attack, as it was in six cases, the immediate symptoms were greatly aggravated, necessitating the administration of anodynes. Subsequent relief was, however, experienced by three of these patients. (Table 2.)

Franklin⁽¹⁴⁾ treated 91 cases of hay fever, 14 of which underwent treatment before the following season. The average number of treatments in these 14 cases was six, at fortnightly intervals, and of these 11 had no attacks the next season, while three were not benefited. Of the 77 cases treated during the attacks, 51 were females and 26 were males, the ages ranging from 10 to 62 years. Of these, 54 had no further attacks, six were not benefited, and 11 failed to report. The majority of the patients received two or three

* There appears to be no standardized classification of rhinitis, but Phillips, St. Clair Thomson, and other authors support the classification employed here.

Table 1 — A Recent Series of Patients With Allergic Rhinitis (Perennial Type) Treated by Intranasal Ionization.

Name	Sex	General Condition	Duration of Allergy	Year Treated	Type of Allergy	Previous Treatment	No. of Ionizations	Duration of Relief in Months	†Degree of Improvement	*Results with Electrolytes other than Zinc
1 J. W.	M.	?	1 yr.	1932	?	Nasal Surgery	2	32	††††	.....
2 E.R.G.	M.	Fair	5 yrs.	1932	Food	Desensitization	2	..	†	Neg.
3 L.S.	M.	?	2 yrs.	1932	?	Caut. of Turbs.	1	30	††††	.....
4 T.S.	F.	Good	1 yr.	1932	?	Nasal Surgery	1	..	†	Neg.
5 F.H.	M.	Good	2 yrs.	1932	?	None	3	..	††	No further change
6 H.G.	F.	Fair	5 yrs.	1932	House dust	Desensitization	2	30	††††	.....
7 L.W.E.	F.	Good	3 yrs.	1932	House dust (?)	Desensitization	4	..	○	Neg.
8 R.T.	M.	Good	2 yrs.	1932	Food	Exclusion of Foods	1	..	†	Neg.
9 K.K.	M.	Fair	2 yrs.	1932	Furs	Change of Occupation	4	36	††††	.....
10 A.V.	F.	?	1 yr.	1932	?	None	2	..	○	Neg.
11 S.E.L.	M.	?	6 yrs.	1933	Horse Dander	None	2	19	††††	.....
12 R.V.	F.	Good	8 yrs.	1933	?	Various	1	16	††††	.....
13 W.S.	F.	Poor	2 yrs.	1933	?	Caut. of Turbs.	1	..	○	Neg.
14 R.L.	F.	Poor	3 yrs.	1933	Food	Exclusion of Foods	1	..	†††	.....
15 J.E.W.	F.	Good	6 yrs.	1933	House dust	Various	2	..	†	Neg.
16 D.K.	M.	Fair	1 yr.	1933	Food	None	1	16	††††	.....
17 A.H.R.	M.	Fair	3 yrs.	1933	Food	Various	3	..	○	Neg.
18 E.R.	F.	Good	8 yrs.	1934	Furs	Various	4	8	††††	.....
19 S.R.	F.	Poor	2 yrs.	1934	House dust	Nasal Surgery	1	6	††††	.....
20 T.G.	M.	Fair	2 yrs.	1934	Physical (?)	Medical	2	..	††	No further change
21 E.L.S.	M.	Poor	4 yrs.	1934	Physical (?)	Medical	2	..	†	††† with copper
22 I.S.	M.	Good	1 yr.	1934	?	Medical	1	4	††††	.....
23 R.T.	M.	Poor	3 yrs.	1934	?	Various	2	9	††††	.....
24 N.R.	F.	Good	3 yrs.	1934	Furs	None	1	8	††††	.....
25 M.G.	M.	?	2 yrs.	1934	Wool	None	2	..	○	Neg.
26 J.H.	M.	?	1 yr.	1934	?	None	1	8	††††	.....
27 A.B.	F.	Poor	1 yr.	1934	?	Caut. of Turbs.	1	..	††	No further change
28 H.S.	M.	Good	6 yrs.	1934	?	None	2	5	○	Neg.
29 R.F.	M.	Good	3 yrs.	1934	?	Dietary	3	..	†	Neg.
30 B.H.	M.	Good	2 yrs.	1934	Food	Medical	1	4	†	Neg.
31 H.H.	F.	Poor	4 yrs.	1934	House dust	Desensitization	2	..	†	Neg.
32 E.S.H.	M.	?	8 yrs.	1934	House dust	Various	1	6	○	Neg.

*Degree of improvement noted as ○ = none; † slight; †† partial; ††† considerable; †††† complete arrest of symptoms.

treatments. Practically all of the patients presented severe symptoms and had previously undergone various types of therapy without benefit.

Franklin makes no comment of the discomfort suffered by seasonal hay fever patients when ionization is instituted during the acute condition. Irrespective of the technic employed, the possible benefits from such therapy are far overshadowed by the increased severity of the immediate and subsequent symptoms characteristic of the seasonal type of hay fever.

Of the 12 cases of vasomotor rhinitis treated by Franklin, only two were definitely relieved. Of the remaining 10, four were improved after six months, and the other six

discontinued their treatments because their condition was not benefited. These findings are in direct contrast to mine, for I have found intranasal zinc ionization more beneficial in vasomotor rhinitis than in the seasonal affection.

Unusual caution must be exercised in treating an allergic nose because of the sensitiveness of the mucosa and the likely harmful effect of the slightest trauma. Only occasionally is it necessary to resort to preliminary anesthesia, a step which, for obvious reasons, should be avoided if possible.

For the evaluation of zinc ionization in the conditions for which this treatment appeared indicated, I made use of control patients. In these, zinc solution was applied topically to

Table 2 — A Series of Patients With Hay Fever (spring and fall Types) Treated by Intranasal Ionization During the Year 1933.

Name	Sex	Duration of Disease	Spring or Fall Type	Previous Treatment	No. of Ionization Treatments	Prior to or During Onset of Symptoms	Immediate Reaction	Ultimate Result	Condition During Hay Fever Season of 1934
1 W.R.	M.	14 yrs.	fall	Palliative remedies	2	prior	mild	No relief	.....
2 M.J.	M.	6 yrs.	fall	Ragweed Desens.	2	prior]	none	No relief	.....
3 E.E.S.	M.	3 yrs.	spring	None	1	during	severe	Marked relief	No severe discomfort
4 C.L.	F.	8 yrs.	fall	Ragweed Desens.	1	during	severe	Slight relief	Severe symptoms
5 R.O.	M.	2 yrs.	fall	Ragweed Desens.	1	during	severe	Marked relief	Practically no symptoms
6 R.E.W.	F.	15 yrs.	spring	Palliative remedies	1	during	severe	Marked relief	Practically no symptoms
7 H.K.	M.	20 yrs.	fall	Change of environ't	3	prior	none	No relief	.....
8 S.S.H.	F.	9 yrs.	fall	Change of environ't	1	during	severe	Marked relief	Slight discomfort
9 J.C.	F.	4 yrs.	spring	Nasal surgery	2	prior	none	No relief	.....
10 B.H.	F.	4 yrs.	spring	Medical	4	prior	none	No relief	.....
11 A.R.C.	M.	6 yrs.	fall	Ragweed Desens.	1	during	severe	Fair relief	Severe symptoms
12 W.E.B.	M.	2 yrs.	fall	None	1	prior	none	No relief	.....
13 H.R.	F.	3 yrs.	fall	None	2	prior	none	Fair relief	Severe symptoms
14 S.K.	M.	18 yrs.	fall	Various treatments	4	prior	severe	No relief	.....

the nasal mucosa by tampon for periods varying from 15 to 40 minutes, in the same manner as employed for ionization, but without the use of the galvanic current. The results were negative in every instance. As this control procedure was performed in more than 100 patients presenting various indications for intranasal ionization, it is logical to deduce that the galvanic current and the ionization process are accountable for the therapeutic effects.

It should be added here, that in my experimental work with intranasal ionization, various compounds of zinc were employed for the electrolytic solution. Copper compounds also were experimented with and were found to be satisfactory when utilized in very weak solution (copper sulphate 1/5 of 1 per cent). In no instance, however, where solutions other than zinc sulphate were employed for the electrolyte, did the results warrant such a change. My observations are at variance with those of other rhinologists^{(15), (36)} who recently have claimed that the addition of cadmium and tin to the zinc solution makes an improved electrolyte for ionization.

Comment

The use of the galvanic current in rhinology is not new. The earliest reference in the lit-

erature, as previously mentioned, is that of Baber's, published in 1898. Since then, various physical intranasal procedures have been employed with a view of favorably affecting the pathologic processes in the different types of chronic rhinitis. Efforts are usually directed towards the inferior turbinates, for apart from the histological alterations, inspection reveals a structural increase, interfering with normal ventilation and drainage of the nose and its accessory sinuses. Reference already has been made to zinc electrolysis of the inferior turbinates, while the actual cautery⁽²⁷⁾ is commonly suggested for reducing these nasal structures. More recently medical diathermy,⁽²⁸⁾ and electrosurgery,⁽²⁹⁾ have been advocated as effective methods.

Zinc ionization appears to have a more pronounced effect than any of the above procedures, its recent extensive use by rhinologists having brought this treatment prominently to the attention of the medical profession.

In simple chronic rhinitis⁽³⁰⁾ the value of ionization cannot be doubted, as experience has demonstrated a rather large percentage of patients to have been improved by this treatment. In chronic sinusitis,⁽³¹⁾ under certain conditions, the method likewise is of pronounced benefit. Whether or not the "aller-

gic nose" can be influenced permanently, remains a problem for continued investigation. While ionization has arrested the symptoms of allergy in some patients, sufficient time has not elapsed, nor has a sufficiently large number of patients been treated to justify a positive report. Zinc ionization being a strictly local measure, it obviously cannot influence the systemic or intrinsic factors underlying any of the allergic nasal affections.

Conclusions

1. Zinc electrolysis of the inferior turbinates was first described by Baber in 1898, but since then the treatment has been used only irregularly.

2. Zinc ionization, a modification of zinc electrolysis, has been successfully employed by the author during more than ten years for intumescent rhinitis and for some forms of sinusitis.

3. Intranasal ionization can be performed with simple and inexpensive apparatus. Solutions other than those of zinc sulphate have not been found to be superior electrolytes, nor have they produced improved results.

4. The method is now being tried extensively for seasonal and perennial hay fever. In the former the author's experience has not been as favorable as that of other rhinologists; in the latter it has been encouraging enough to warrant further trial.

5. That the procedure definitely possesses merit in nasal cases other than those of an allergic nature has been established.

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THE MAMMARY PROBLEM *

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The diagnostic difficulties and therapeutic limitations of certain affections of the mammary gland constitute a problem of interest to general practitioners as well as surgeons and pathologists. It is therefore timely critically to review the salient features of the problem with a view of ascertaining its probable and possible solution.

Diagnostic Difficulties

Examination of a patient for mastopathy is directed toward a differentiation between inflammatory and neoplastic disease. While there are easily recognized types of mastitis and of tumor, we find between these extremes nuances that baffle even experts. Experience has shown that deep seated inflammation may simulate a tumor at least for a while, and a true new growth may be hidden and unrecognized under a superimposed inflammatory process.

The positive establishment of a tumor at once raises the problem of its histologic character. The decision requires extreme care for more than scientific reasons. It must not be overlooked that many women develop a cancerophobia when they detect a lump in a breast, a psychologic factor which plays at least as important a rôle in daily practice as the solution of technical problems. If such a lump can be diagnosed with absolute certainty as a benign neoplasm we have no problem, but in every doubtful case one must exercise what

the French aptly call *savoir faire* to avoid subsequent reproach and loss of professional prestige. One wonders which is the greater evil—to operate radically for an assumed malignant neoplasm only to find out that it was benign in character, or to assure a patient of the harmlessness of a growth, later to discover that a radical operation is imperative. To be safeguarded against such errors our entire diagnostic armamentarium may have to be brought into play. What are the means to aid us in arriving at a correct diagnosis?

Physical Examination

The anamnesis may reveal suggestive data in many instances, but these alone cannot be fully evaluated. An elderly mother with a personal and familial history pointing to a given neoplasm being a malignant one, may have a benign growth of her mamma, while a young virgin with an excellent history exhibiting an apparently encapsulated tumor may actually have a carcinoma. The anamnesis often fails us in detecting a causative factor or to establish the duration of a suspected neoplasm, because trauma, if any, is usually forgotten, and growths in the mammary gland are detected accidentally in the great majority of patients.

We regard inspection as a fruitful method of physical examination. If a patient be seated on a chair so placed that the light falls laterally on both breasts, and the patient holds her arms high above her head, any change in the color of the skin, in the size, shape,

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and contour of the affected breast will be detected at a glance. In most instances comparison with the normal breast is available, so that one can also recognize improper alignment of the nipples and mammary retraction. Evaluation of the latter is predicated on the absence of a previous history of mastitis, because both infections and surgical incisions result in adhesions and retraction of the nipple in very many cases.

Palpation aids us in determining the consistence and mobility or fixation of neoplasms, or the presence of suppuration in inflammatory affections. A fixed growth is virtually pathognomonic of malignancy, if due to no other cause.

Transillumination, which was first advocated by Cutler, in 1929, is a valuable diagnostic aid for the differentiation of solid growths from those of a cystic character, but cannot aid us in differentiating a malignant from a benign solid growth. The same holds good for roentgenography, at least with the present technic. Serology is mentioned here solely to express appreciation of the splendid efforts of research workers to find for our benefit a test of the same clinical value as that for syphilis. Unfortunately no reliable test has been found, and none need be looked for until we know the true cause of malignancy.

Of late highly important investigations have been carried out with tissue fluorescence. The labors of Plotnikow of Zagreb, and of Sutro of New York, among others, have shown conclusively that malignant tissues placed under ultraviolet light under an arrangement of a simple and inexpensive appliance, fluoresce in a manner easily distinguished from the appearance of normal tissue. It has been shown by countless observations with all kinds of tissues that where the naked eye will fail to detect changes in tissues under ordinary light, the ultraviolet rays reveal their presence unmistakably. While this agent is inapplicable when a neoplasm is hidden under the cover of the skin, it becomes invaluable after the removal of the tumor. I shall show later that there are many occasions for its employment.

Histopathologic examination is our diagnostic sheet anchor and the final solution of our problem. It is admittedly not free from certain drawbacks, but until a simpler and more convenient method will be found, we simply have to adapt ourselves to existing conditions. This holds especially good for the surgeon

who is compelled to work without the cooperation of a competent pathologist in his locality. It is, of course, ideal if a surgeon also possesses the skill and knowledge of a reliable pathologist, but the advances in the two disciplines are so comprehensive that a division of labor becomes imperative with the overwhelming majority of medical practitioners.

Histologic examination, too, is not a pre-operative diagnostic measure. I have repeatedly stressed the fallacy and danger of the teaching that, for purpose of a biopsy, it suffices to remove a small section of a growth. It is fallacious because comparatively large neoplasms may have a small malignant area somewhere near the center of the mass, so that the removal of even a third of the tumor from the periphery will necessarily result in failure to determine an existing malignancy and lead to an erroneous therapy, for which the surgeon and not the pathologist must be held responsible. The teaching is dangerous because such sections for biopsy may be productive of metastases. It should, therefore, be accepted as law, that for diagnostic as well as therapeutic purpose tumors should be removed in toto and in a proper manner, that is through an apparently normal zone, and even that by means of the surgical high frequency current. We must stress that no surgeon has a right to cut into a tumor, not even benign ones, except to evacuate a cyst, for the risk of causing degeneration of the growth is a real one.

The surgeon operating in a well-appointed hospital has the great advantage of covering the wound created by the removal of a suspected tumor and await for a few minutes the pathologist's report, which will cause him to decide whether the wound is to be definitely closed or the preliminary operation concluded by radical ablation of the mamma. The surgeon who lacks such cooperation must close the wound and wait the few days involved in the transmission of the specimen to the nearest pathologic laboratory and the report after its examination. If under such conditions the surgeon employs his equipment to determine the fluorescence of the different parts of the extirpated growth before sending it to a laboratory, he will have a tentative warning what to expect, and act accordingly, at least so far as managing the patient is concerned.

Many eminent surgeons have maintained

that pathologic reports based on the examination of frozen tissues are not reliable. For the vast number of benign and malignant neoplasms that constitute our daily work, this must be denied. There are occasions, far and few between, when pathologists admit doubt, in which case the whole responsibility falls on the surgeon. If, however, pathologists will cause unstained tissues of a doubtful nature to be tested by fluorescence, they will beyond any doubt, obtain additional photo-macroscopic data which should aid them in coming to a decision. As a general proposition it may be said that proper study of a frozen specimen has always given findings that were later confirmed by standard methods of tissue examination. The same holds good for the determination of the degree of malignancy according to any of the accepted groupings. While this information has only prognostic value, it has in some instances served me to modify the operative technic.

Therapeutic Problems

Discussion of puerperal mastitis as a therapeutic problem may sound anachronistic, but I am constrained to take exception to the widespread teaching favoring early and extensive incisions. I have already alluded to the adhesions and mamillary retraction following such therapy, and I am firmly convinced that they can be obviated. Forty years ago, August Bier has shown that hyperemia is a biologic reaction to infection, which should be usually favored rather than suppressed. This epochal teaching is virtually ignored in most parts of the United States. Even our best text books swish over the subject of the use of artificial hyperemia as a therapeutic agent, without giving the reasons for nor the technic of its application. Yet it is precisely in mammary infections that we can obtain by it almost dramatic results. Since 1905, when I studied the method in Bier's clinic, I have treated all kinds of infections of the mammary gland with a simple glass vacuum appliance, without having to do more in addition than to make one or two stab punctures with a narrow-blade scalpel when fluctuation was recognized. The mechanical force of suction in the thinned air between the appliance and the mamma empties the abscesses without insult of the affected tissues. Healing takes place without or with minute scarring and without subsequent adhesions. I have yet to see a case in which

this simple method of treatment proved inadequate.

The problem of the treatment of malignant neoplasms of the mammary gland ordinarily is not difficult of solution. Until we know the definite cause of malignancies we can only pursue a course of more or less radical extirpation of the breast. Knowing as we do the chemistry and metabolism of cancer cells and their tendency to infiltration, the wonder is that not all surgeons in the world have afforded their patients the advantages of electrosurgery. Certainly all know the underlying reasons that prompted the utilization of the actual cautery for surgical operations, a method that would still be one of choice for malignancies, were it not that we possess in electrodissection a technically more convenient and histologically far superior and safer means of combating malignant disease.

The only problem meriting exhaustive discussion, would time permit, pertains to the so-called precancerous lesions. Here I must remain content with the assertion that I regard the term as a pathologic absurdity. A lesion is either malignant or it is not. How long was it that Paget's disease of the nipple was regarded as a precancerous lesion? Today we know it is cancer. A similar situation persists today with regard to Reclus' disease or, as it is more commonly called, chronic cystic mastitis. The very multiplicity of pathologic nomenclature, of which Warren's cystadenomatosis is doubtless the most logical one, shows why in some clinics complete ablation has become routine, while in others such radical procedure is rejected. I have only seen three genuine cases of cystadenomatosis in my long practice, and I have therefore no decisive voice, nevertheless it is a fact that I obtained permanent cures by submammary partial resection. Today the same quarrel is heard about the so-called true bleeding nipple, that is the one not associated with palpable malignancy and certainly not the periodic bleedings of a vicarious nature. I feel confident that these cases are not at all surgical problems, but affections of a hormonal nature which should be left to the internist.

I have alluded to the fact that on receipt of a report of low grade malignancy I feel at times impelled to modify the standard operative technic. Electrosurgery does not involve a need for changing one's accustomed method of operation. Personally I begin at the axilla

to ascertain the amount of involvement of the glands and then work down and around the breast with the electrotome, because by that technic I also lessen the time of exposure of the large wound of the thorax. I contend that in mild forms of malignant tumors which are not adherent, there is no need for the extirpation of the pectoralis major. It is about seven years that I have avoided too radical measures in suitable cases and so far have had no occasion to regret it.

My first electromammectomy was performed in April, 1928, for a case of medullary carcinoma. I had quite a time to convince the attending physician of the advantages of the procedure, and finally won him over. Up to the end of 1929, I had eight cases of cancer and one of sarcoma of the breast. Of these one is dead, the others are living and in fair health, and only one showed a recurrence in the scar, about six months after her operation. This was electrocoagulated under local analgesia and the patient was reported in good health very recently. Of the above cases two had cancer *en cuirasse*, which in one instance was pronounced incurable by a prominent surgeon. I cite these cases because they show that electrocoagulation has narrowed our concept of inoperability of malignant neoplasms of the breast. I was at first astonished to see the appearance of clean wounds after some time, but now I expect no other outcome in cases that are not beyond all human aid. The death case mentioned refers to the second case of cancer *en cuirasse*, who died about eighteen months after her discharge. I learned only indirectly that she had died in coma. I presume, therefore, that she died of carcinosis.

Too little time has elapsed and too few cases have been observed to justify a comparison of the results of electromammectomy with classic ablation. The huge statistics of the pre-electrosurgical era will have to be greatly modified, for we know today that many cases that had been reported as malignant were found to have been benign on re-examination of the microscopic slides, in quite a number of instances. Nevertheless I submit my impression that we have in electrosurgery a means of effecting more lasting cures than is attainable by scalpel surgery.

Could we but influence our patients to undergo periodic physical examination, so that we would see the symptomless neoplasms of the breast at an early stage, I am sure that

electrosurgery would revolutionize their curative results, and that without resort to post-operative radiation. It is not beyond the realm of possibility that physical therapy may yet find an agent that will render classic and high frequency surgery superfluous in the treatment of inflammatory and neoplastic disease of the breast, at least there is some reason to believe in the possibility, but until that time arrives we are justified in formulating our therapeutic problem in two sentences.

In the therapy of disease of the mammary gland as in that of all human afflictions the supreme law is: *non nocere*, which dictate to cause no harm presupposes a conservatism on physiologic principles. In the case of malignant neoplastic disease appropriate radical surgery is the only form of conservatism, because it saves life at comparatively small cost.

Discussion

Dr. Edward J. Klopp (Philadelphia): Diagnosing advanced cancer is particularly easy in the breast. Diagnosis in cancer that is early is what we must dwell upon in order to avoid the far advanced cases that Dr. Trowbridge has shown on the screen.

Cancer of the breast must be differentiated from chronic cystic mastitis. It is easily differentiated from benign tumor. Dr. Blech stressed the fixity of the cancer to the pectoral sheath or the pectoral fibers. We hope to see cancer before it has become attached, either to the pectoral sheath or to the skin. Bear in mind that cancer of the breast is fixed in the breast tissue itself. It isn't slippery, it doesn't glide about as does a fibroid adenoma. It is difficult to say when an early cancer is fixed in the breast.

Place the patient before a light so that one will see the difference of contour, raising of the involved nipple, the retraction, the shiny skin over the tumor and the thickness of the skin is always present in far advanced cancer. It is the early nodule that we must detect.

How do you detect that? With the patient in a sitting posture, with a flat hand placed on the breast, you can detect a presence or absence of a tumor. After having determined the other characteristics, as described by Dr. Blech, then have the patient lie in a recumbent posture. In that position we determine the character of the tumor itself, the fixity of the breast tissue. After that has been determined, fix the tumor between thumb and index finger in one hand so as to keep it from gliding about and pressing on the summit of the tumor with the index finger; if such a tumor is hard it is a cancer and absolutely nothing else.

Chronic, cystic mastitis sometimes misleads us. That is hard and tense and does not fluctuate. Yet, one gets the shoddy sense on the palpating finger which is produced by the small

cysts in the condition we call chronic cystic mastitis, which is not, I believe, an inflammatory lesion at all.

There is no way of differentiating except one. Acute cancer, which occurs late in pregnancy, or during lactation, sometimes called carcinoma mastoides, or inflammatory carcinoma—and we might better call it lactating cancer—is the most violent, the most destructive of all cancers of the breast. I do not know of a patient who has lived three years who developed an acute cancer during the lactating period, the kind that does not begin as a definite nodule but diffuses rapidly throughout the breast and causes a dusky, reddish discoloration of the skin, somewhat on the order of sarcoma, and is often mistaken for suppurative lesions because the patient is lactating and the breast instead of being raised and deformed, as Dr. Blech described scirrhus cancer, has a beautiful virginal prominence placed firmly upon the chest wall. Most of those that we see in our surgical work have been opened by the obstetrician or the attendant, thinking that it was cancer. Such a breast should not be removed by operation. The best results that we have seen and heard of were those treated by combined x-ray and radium irradiation.

Eighty-five per cent of cancers of the breast can be absolutely and definitely diagnosed before the patient reaches the operating room. If in doubt, an incision should be made over the tumor and the tumor freely excised. The surgeon, as well as the pathologist, states that scirrhus tumors comprise at least eighty-five per cent of the tumors of the breast. If it is scirrhus and it is cut, there is resistance, and when it is scraped, it has the sound of a ripe pear being scraped. The surfaces are concave and not convex. It is not encapsulated. If one scrapes the cut surface one can collect material which is sometimes called cancer juice.

What about the frozen section report? In 118 cancers of the breast that we personally operated upon in the last three years, three of them were doubtful. They were examined by frozen section. Two worked out, even at frozen section and one was positive cancer which could not be diagnosed positively at the time of the operation.

The beneficial factors of the electrothermic knife for amputation have been stressed. No one could possibly doubt it. All surgeons have their differences of opinion regarding the removal of the breast. The axillary nodes are all removed at the time of the operation, but all the time that you are cleaning out the axilla, you are massaging the tumor in the breast and the gland in the axilla, and you have not cut off the lymphatic pathway to the abdomen. Why not, therefore, cut off the fascia over the rectus abdominis, reflect it up from the rectus, cut off the pathway, then resect that tissue to the breast, pack sponges in there and dissect from above downward?

Dr. E. H. Trowbridge (Worcester, Mass.): The anatomy of the breast presents a complica-

tion of structure not present in any other organ in the body. We deal with glandular tissue, fibrous tissue, fatty tissue, lymphatics coursing in various directions accompanied by numerous vessels. By both of these channels the elements of cancer tend to center in the glandular bodies in the mediastinum, axillary and supraclavicular areas. Any so-called "lump" in the breast demands immediate attention, and the diagnosis at once to be established.

Thorough inspection, delicate palpation and a minute history furnish the physician and the surgeon the clue as to whether the lump is benign or malignant.

In reference to palpation, may I briefly state that it is the speaker's custom after placing the patient on the examining table, to then apply the palm of the hand over the breast—the nipple being between the base of the middle and ring fingers—make light pressure, and then move the breast laterally, longitudinally, and circularly over the chest wall—never to pinch or squeeze the lump. In so doing, the nature of the lump and its movability is easily determined.

The laity must be convinced that pain early in the breast in cancer is practically a negligible factor. Too often, the patient is astonished when informed that the lump may be cancer, as the statement from her is, "Why I have not had any pain in the breast, and if cancer, I thought I must have pain." This conception deters the patient from consulting the doctor at the earliest opportunity, and hence, the delay.

Two of the saddest experiences in my career was one woman of excellent physique, the wife of a prominent man, who was told by her doctor that the lump in the breast would probably not amount to anything and to wait until it gave her trouble. On examination, the supraclavicular glands had become involved and this condition influenced her to consult the speaker, who found her condition extremely critical, with ultimately a fatal outcome.

The second, a patient, in an adjoining town, had noticed ulceration about the nipple and, on examination, I found extensive involvement of the breast demanding immediate amputation; she, too, had metastasis with fatal result. Both of these patients expressed an opinion that they thought their condition not so extremely critical as no pain had been experienced. In my opinion, it seems a fairly easy problem to decide the question of a benign or malignant condition.

Any surgeon would be extremely embarrassed, professionally and perhaps financially, if after removal of the breast they received a pathological report that a non-malignant growth was present. I desire, at this time to make the unequivocal statement that no surgeon is justified in enucleating any lump in the breast with the scalpel, unless an immediate biopsy is performed to determine the nature of the growth; in this respect, I most heartily endorse the attitude of Dr. Blech, and even then would prefer the electro-surgical knife.

It must be admitted that any mass of a cystic nature will demand most thorough investigation and examination in order to decide what line of procedure shall be adopted. If on aspiration of the cyst, a bloody material is obtained, I, personally, would not hesitate to perform the radical operation by electrosurgery.

As to the technic to be adopted in amputation of the mamma; this can be demonstrated by a cinema film. But as time does not permit, I will briefly state that the incision commences at the insertion of the pectoralis major and proceeds downward anteriorly and posteriorly just far enough to allow complete removal of all the tissue in the axilla and also to sever the attachment of the pectoralis major, pectoralis minor, and then the entire mass of muscles with the breast is removed, en masse, from the chest wall. The axillary vessels are duly protected by placing a wooden throat stick over these vessels when using the electrosurgical knife. In cleaning out the axilla, in this procedure, the tissue should be cut or severed from the chest wall by the knife held parallel to the chest wall and thus avoid any risk of nicking the pleura. During the past year, the above mentioned accident occurred twice (without any complication, however) so now I sever the mass during the act of expiration.

I wish to emphasize the statement of Dr. Blech that every surgeon should strive to so coapt the borders of the incision so that only a minimum scar is in evidence of any surgical procedure. In so doing, we relieve the patient of any undesirable reminder of her operation. In this discussion of the use of electrosurgery, I feel compelled to emphasize the warning that extra care must be exercised so that there shall be no sloughing of or in the wound. This sloughing is the result of carbonizing the tissues due to too slow manipulation of the electrosurgical knife. This result (sloughing) accounts for so many surgeons not using or adopting this technic, and condemning the procedure when in reality the lack of complete knowledge of details on the part of the surgeon is the real cause.

Dr. A. David Willmoth (Louisville, Ky.): I agree with Dr. Blech in his treatment of mastitis. Free incision should not be done, nor should one intervene vigorously else some infection may pass to the surrounding tissues.

As to the study of tissue through fluorescence, one must be sure of not being color blind.

Palpation of tumors of the breast should be done with the utmost care. Henley found that five medical students examining the breast increased the mortality rate very materially. One should even caution the patient not to be manipulating her tumor, to prevent lessening her chances of getting well.

I am heartily in accord that a tumor should not be cut into for biopsy. According to the best surgical teachings it is advisable to extirpate it widely and carefully and then submit it to the pathologist. When the pathologist disagrees with you the patient always gets well.

It is in the case where the pathologist agrees to a definite cancer that the breast must come off.

It is the opinion of those best versed that when a woman has a cancer of the breast, she should be pre-x-rayed. The additional three weeks is not going to interfere with recovery so far as the delay is concerned, but on the other hand may perhaps materially aid in her recovery. It doesn't necessarily mean that we should use six or seven hundred thousand volts. It remains yet to be seen whether such heavy dosage has any therapeutic superiority over 160 K.V.

Too much cannot be said about cancer of the breast. Every surgeon sees lamentable cases that have gone almost to a terminal stage before they have consulted a doctor. Personally, I do not believe that such cases should be submitted to radical removal. Every woman with a cancer of the breast should get a chest x-ray. If it has metastasized into the lungs, you might as well let her go home and keep her comfortable unless she has a sloughing, nasty, foul mass that can be removed. In such cases one should not go into the axilla, because metastasis is already in the lungs and cannot be reached except with x-ray.

The burning question of the day in cancer is now the method of the surgeon. You do not have to use a scalpel in these times. A man who uses a scalpel every day is not qualified to use an electrothermic cutting knife. It takes time and effort and study to perfect one's self with the electrothermic method, which will yield better results in cancer cases.

Dr. Gustavus M. Blech (closing): I have endeavored in the presentation to avoid discussions of matters that are given in text-books, and will therefore limit myself to a few remarks dealing with apparent differences of opinions by the discussants. In the essential features we seem to be in accord, as, in fact, there can be a diversity of opinion only on technical characteristics. I, for one, am inclined to reject preoperative radiation in cancer of the breast, because the logical thing to do is to remove it electrosurgically at the earliest possible moment. The electrotome can destroy malignant cells instantly, while the x-rays require time, to say nothing of their not being easily controlled. I believe in cases of a fully developed carcinoma postoperative radiation is useful. Incidentally that is why I begin the extirpation of the mammary gland by exposing the axilla, because it shows almost at a glance whether the affection has existed a long or a short time in a relative sense. We have said nothing about the involvement of the lymph glands, especially in the supraclavicular region, because the enlargement of these glands today presents no problem. I think it is good practice to dissect all palpable glands, while those that cannot be palpated may yet be indirectly reached through the endothermic effect during the procedure.

Dr. Trowbridge has clearly set forth the advantages of electrosurgery over cold-knife surgery, with all of which I am in absolute agreement.

Dr. Willmoth's allusion to color-blindness has

no application to the diagnostic value of ultraviolet fluorescence of tissues, because every surgeon is assumed to possess normal faculties. Personal study will convince any one of the great value of the method as such.

NEWER ASPECTS OF IONTOPHORESIS FOR ARTHRITIS AND CIRCULATORY DISTURBANCES *

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Medical history discloses many instances in which innovations first hailed as panaceas have eventually been relegated to the background in proportion as experience failed to corroborate their early claims. With elapse of time many of these forgotten measures have been rescued and successfully utilized under a more restricted régime than originally propounded. The story of iontophoresis is a colorful but true illustration of this thesis. Employed as early as 1749 by Privati for cataphoretic treatment by means of the static current, Rossi, in 1802, is the first to be credited for the introduction of mercury into the skin by the galvanic current. Subsequently its extended use especially during the latter half of the last century became known to us under the description of "cataphoresis" or electric endosmosis. Indeed, Faraday in his nomenclature on electrolysis called those ions which appear at the anode, or positive pole, "anions" and those which appear at the cathode, or negative pole, "cations." Those who have difficulty in memorizing Greek terms and their meaning will grasp the principle of ionic medication by simply remembering the basic principle underlying the action of a flow of electricity: Like electricity repels, unlike electricity attracts. Ions with a positive charge, such as metals and alkaloids are repelled from the positive pole, while those with a negative charge, such as iodine and chlorine are repelled from the negative pole.

Until Ledue⁽¹⁾ established by his classical experimental data the polarity and penetration

effect of drugs through the skin by means of the galvanic current, no worthwhile therapeutic use was made of this possibility. His work inspired increased interest in "ionic medication," and the medical literature of the early period of this century contains many reports of the remarkable effects of ionization in a variety of conditions. Reversal in the popularity of ionic medication occurred when various investigators proved that "medicinal" ions galvanically introduced are small in quantity and only effective in the most superficial of tissues. There is no basis for the hope as held out by the early advocates of ionic medication that the cells of a deeply seated joint or nerve, or of a whole region of the body, may be flooded by *any* form of medication when sent through the skin by a current within the tolerance of the patient. On the other hand there can be no doubt in view of still newer research that drugs suitable for cutaneous administration can be effectively introduced both for local and general action.

For the past fifteen years or more, iontophoresis or ionic medication when used at all in this country has been restricted to treatment of pathological changes located in the skin and mucous membranes, such as zinc iontophoresis for certain catarrhal conditions associated with affections of the ear, copper iontophoresis for certain forms of chronic endocervicitis, and for indolent ulcers, sinuses, and chlorine ionization for dissolution of small areas of accessible scar tissue (Kovács, R.⁽²⁾). Abroad, salicylic, iodine, calcium and lithium iontophoresis was used in the treatment of chronic arthritis (Laqueur⁽³⁾) with indifferent results. After a period of over-enthusiastic

* Read at the Thirtieth Annual Session of the American Congress of Physical Therapy, Philadelphia, September 10, 1934.

use of diathermy for all kinds of conditions and its all too evident failure to benefit materially certain forms of chronic arthritis and fibrositis, some clinicians, notably Kowarschik⁽⁴⁾ recommended the employment of the galvanic current in large amounts for these conditions.

The superior therapeutic effect of the galvanic current on circulation was demonstrated by the experimental investigation of Freund and Simo⁽⁵⁾. The "galvanic skin reaction," obtained by them with applications of rather short duration produced vasomotor stimulations lasting for several hours or days. Proper spacing of these treatments will undoubtedly maintain this stimulative effect, promote a better nutrition of the parts, and enhance the natural forces of restitution in the skin as well as in the deeper tissues.

On the basis of authoritative, clinical and experimental evidence regarding the therapeutic efficiency of the galvanic current, it required but little time to suggest its value for the introduction of vasodilating drugs on a rational and clinical basis. Recent reports have moreover indicated the close connection between disturbed peripheral circulation and arthritic conditions (Pemberton⁽⁶⁾, Kovács, J.⁽⁷⁾) and has provided additional reasons for use of iontophoresis with selected vasodilating drugs.

Iontophoresis by Vasodilating Drugs

Histamine and choline compounds are the drugs best employed for this purpose. Experimental evidence has shown that they are effective in a variety of conditions associated with vascular spasm and impaired circulation of peripheral vessels. It has also been shown that when administered orally or subcutaneously these drugs provoke only a brief vasodilating effect.

Histamine iontophoresis was first employed by Deutsch⁽⁸⁾. Using a 1:1000 solution of histamine acid phosphate from the positive pole for a few minutes, he produced an immediate, intense skin hyperemia, this being soon followed by typical wheals, and the whole area turning into a patch of urticaria. The temperature of the treated area was raised from 2 to 3 degrees C., the skin retaining its abnormal appearance for five or six hours. With this method of treatment Deutsch reported favorable results in myositis (muscular rheumatism); in chronic arthritis the results were

indifferent. The strong local reaction by histamine application and the demonstrated fact that it acts primarily on the skin capillaries, led to search for more convenient and effective methods based on the same principle.

Simonart⁽⁹⁾ and others called attention to the usefulness of choline compounds to increase peripheral circulation, by the dilation effect on the arterioles. Acetyl choline was the first drug employed of this group, and while it was found fairly effective by subcutaneous administration, its usefulness was limited by the fact that it is rapidly destroyed by body fluids and blood. Acetyl-beta-methyl-choline chloride — abbreviated mecholyl — another compound of this group, synthesized by Major and Cline⁽¹⁰⁾, has been found to offer greater possibilities of clinical usefulness. It is destroyed more slowly in the blood and body fluids, is more potent and lacks almost entirely certain undesirable by-effects of acetyl choline. Its administration by iontophoresis was first attempted by one of us (Kovacs, J.⁽¹¹⁾) and the findings were reported in two previous papers^{(11), (12)}. The present report embodies the results of clinical work extending over two years.

Table 1 shows comparative effects of vasodilating drugs administered by different methods.

Technic of Mecholyl Iontophoresis

A standard (1 per cent) solution of mecholyl is introduced into the area to be treated through the polarity effect of the galvanic current. The drug being an alkaloid, it must be introduced from the positive pole. The drug is supplied in vials containing one gram, and the contents of one vial dissolved in 100 cc. of distilled water furnishes the required one per cent solution. Instead of gauze, absorbent paper is saturated with the solution and is wrapped around the parts to be treated. After considerable experimentation with various thicknesses of blotting paper, reinforced asbestos fabric paper was found most satisfactory. This material absorbs sufficient fluid, keeps moist for a long time, and does not disintegrate in the course of the treatment. A malleable metal plate with a clip connection is placed over the wet asbestos paper and connected to the positive pole of a galvanic generator. A large (5x7) regular moist pad electrode is used as a dispersive electrode, and, being placed under the back or over the ab-

Table 1 — Study of Comparative Methods for Administering Different Vasodilating Drugs

Drugs	Mecholyl	Acetyl Choline	Histamine	Nitrites
Oral	Mild general effect, last $\frac{1}{2}$ -1 hour. Dose: 100-200 mgm.	None.	None.	Powerful general effect, lasts 10 to 60 minutes depending on the drug.
Subcutaneous	Powerful general effect, lasts 15-20 minutes. Dose: 5-25 mgm.	Mild general effect, lasts 15-20 minutes. Dose: 100-200 mgm.	Used only for tests. Dose: $\frac{1}{4}$ -1 mgm.	None.
Intravenous (Dangerous, Toxic)	Pronounced general effect, lasts 20-40 min.	Mild general effect, lasts 10-20 minutes.	No general effect.	
Iontophoresis	Pronounced local effect, lasts 4-10 hours. Dose: 0.5-1 solution.	Mild local effect, lasts 1-2 hours. Dose: 0.5-1 solution.	Pronounced local effect, lasts 2-4 hours. Dose: 1:20,000 solution.	

domen, is connected with the negative pole. For the sake of convenience, a foot or arm bath may also be used as a dispersive electrode. It is possible to treat two regions of the body at the same time with the help of a bifurcated cable from the positive pole.

After all connections are securely made — care being taken that metal parts do not come in direct contact with the skin — and the patient in comfortable position, the current is turned on. On account of the comparatively large area treated, the amount of subjective feeling — tingling — under the electrodes is less than with the ordinary galvanic treatment. It is possible to start with from 5 to 10 milliamperes and gradually to increase the amount within five minutes up to 20 to 30 milliamperes. The current strength must, of course, be always within comfortable toleration of the patient. Treatment is given for twenty or thirty minutes, and at the end of this time the current is slowly turned off, the electrodes and wrappings are removed, the parts are carefully inspected, dried, and covered.

Apparatus

The administration of ionic medication requires only the simplest type of apparatus and accessories. For this purpose one utilizes a source of galvanic current, measured by a milliammeter and controlled by a rheostat, two conducting cords, a dispersive pad electrode, an active plate electrode, and fabric paper. Most of the galvanic generators offered for general use are of the motor gen-

erator type and are somewhat bulky for simple ionic treatment, but this is not an insurmountable objection. The employment of thermionic (vacuum) tubes for the "rectification" of the commercial alternating current into a fairly smooth galvanic current has in recent years enabled the construction of small galvanic generator units.

After considerable experimentation, we designed and successfully employed a still simpler galvanic outfit by taking advantage of the easily available radio B batteries. It has been generally recognized that chemical generation furnishes the smoothest and most even form of galvanic current. One 45 volt B battery connected with a rheostat and a plain milliammeter, placed in a simple box, furnishes a light and fully efficient galvanic generator. The chief advantages of this equipment are its portability and its independency of electrical supply.

Physiological Changes

Well defined objective as well as subjective local and general changes and consistent laboratory findings follow each application of mecholyl iontophoresis.

Local Effects. The objective changes are — (1) slight redness of the skin, which persists for one and a half to two hours, this being probably due to the dilation of the deeper small arterioles. Signs of (2) "gooseflesh" immediately after treatment, which disappear after 10 to 30 minutes. This is due to stimulation of the erector muscles of the hair follicles. (3) Perspiration immediately after

treatment, which continues for 8 to 10 hours. This effect is most likely due to the direct action of mecholyl on the sweat glands or their nerve supply. (4) Increase of skin temperature from 4 to 10 degrees Fahrenheit and remaining from 2 to 4 hours, this being explained by the hyperemia already described. When applied in the region of the salivary glands, the treatment produces increased salivation.

The subjective changes are a sensation of warmth in the parts treated, this feeling being maintained from 24 to 72 hours, and in some cases even longer as treatment is continued.

The laboratory findings show (1) increase in the rate of capillary flow without enlargement of the capillaries; neither are the number of visible capillaries increased after treatment. (2) A slight increase of the local leucocyte count; differential and total blood counts taken from the part before and immediately after treatment showed no change in the differential but a slight increase in the leucocyte count (from 600 to 1,000, in one case 3,000). This was a constant finding but is recognized to be within the limits of error.

Concurrent with these objective and subjective physiological findings, there was a marked relief of pain, and a feeling of comfort in the parts treated. In cases of joint affections, there was usually a reduction of swelling and an increase of mobility.

It could be demonstrated without difficulty that the effect of mecholyl is specific and not a simple galvanic effect. This was done by treating both hands of a person simultaneously, one hand with the solution of the drug and the other with normal salt solution. Both hands were connected to the positive pole with the help of a bifurcated cable. The dispersive negative electrode was placed on the back. Treatment was given for twenty minutes with a galvanic current of the strength of 20 milliamperes. At the end of this period the hand treated with the normal salt solution remained cold, showed no perspiration, only a slight redness in patches; the capillary picture remained unchanged. The hand treated with the drug showed all the characteristic symptoms following mecholyl iontophoresis: an increased skin temperature, perspiration (which continued 6 to 10 hours), gooseflesh, a faster capillary flow and a slight diffuse redness.

General Effects. When large areas are treated there is often a marked general ef-

fect, consisting of flushing of the face, perspiration all over the body, increased salivation, a rise of the pulse rate, a slight lowering of the blood pressure, and, at times, increased intestinal peristalsis. These effects become generally manifest after ten minutes and cease soon after the treatment is brought to an end. Their intensity varies according to the individual.

The occurrence of these systemic effects proves that the action of mecholyl by iontophoresis is not confined to the surface of the skin and hence it is quite different from a simple counterirritant. The general reaction points to the absorption of the drug by the circulation. The therapeutic effect of this form of treatment might be explained by the deposition of the drug in the superficial tissues and its slow absorption from there, causing a pronounced and prolonged local effect combined with prolonged slight systemic vasodilatation.

Clinical Results

Having at our disposal a physicochemical agency which brings about a profound and fairly well lasting stimulation of local circulation, we should expect beneficial effects in pathological conditions related to impairment of the peripheral circulation.

Chronic Arthritis. Chronic arthritis is a generalized disease with joint manifestations. It requires treatment of the arthritic constitution as well as of the local changes⁽¹³⁾. For the relief of painful and disabling symptoms and for the amelioration of the local organic changes, local treatment is indispensable. Mecholyl iontophoresis offers a welcome addition to our therapeutic armamentarium for the latter purpose. Seventy-five patients with chronic arthritis have been treated so far; 28 were osteoarthritics, 47 were of rheumatoid arthritis. The results were most striking in the latter group. Ninety per cent of the cases of rheumatoid arthritis, who were previously treated by diathermy, short wave fever, x-ray, with little or no relief, showed clear-cut improvement after the first few treatments with mecholyl iontophoresis. In order to properly evaluate results we considered as a criterion of slight improvement when there was some lessening in pain and some improvement in function; if there was a marked increase as to function and decrease in deformity we considered the case greatly improved. During the

Table 2 — Comparative Physiological Effects of Mecholyl and Histamine Iontophoresis

	Mecholyl Action mostly on arterioles.	Histamine Action mostly on capillaries.
Topical effects.	Increased skin temperature for 2-8 hours. Increased sweating for 4-10 hours. Goose-flesh lasting 10-20 minutes. Increased oscillometric reading. Faster capillary flow. Slight redness. Slight increase in local white blood cell count.	Increased skin temperature for 2-4 hours. Enlarged capillaries. Increased capillary permeability. Wheal formation. Faster capillary flow. Definite redness.
Systemic effects.	Flush, sweating, increased salivation, lowered blood pressure, increased pulse rate, increased intestinal peristalsis, increased metabolism. Electrocardiogram: PR conduction time increased, T wave increased amplitude, rate slower. Effects last 20-40 minutes.	None.

time that this experimental series of cases received mecholyl iontophoresis, no change was made in the general treatment, in order not to confuse the picture.

Patients with chronic arthritis were treated two to three times a week, according to the individual reaction, for the first five to six weeks and once or twice a week subsequently. The larger percentage of our cases were old clinic patients, others were private patients, and it was a striking observation that both classes of patients, who previously had had all kinds of treatments with negative results, eagerly and regularly kept up this form of treatment. Most of these patients received so much subjective comfort from the outset that they were content to wait for whatever organic improvement they might obtain. A number of cases with advanced rheumatoid arthritis of the hands showed not only definite elimination of swelling and deformity but also marked improvement in strength, proving that there must be a definite inter-relationship between peripheral circulation and joint function, and that improvement of the former leads to amelioration of the latter. Further studies are needed to determine whether the increased capillary circulation is responsible for the reduction of swelling, or whether the reduction of swelling, by relieving the tension of the tissues, facilitates the capillary circulation, following iontophoretic treatment. Massage was employed only in a number of cases.

Osteoarthritis did not show similar clear-cut improvement. In the type of osteoarthritis confined to one or two of the larger joints, diathermy is still our method of choice, just

as in cases of rheumatoid arthritis affecting several of the smaller joints, hands and feet as a rule, mecholyl iontophoresis has now become our method of choice — at least we know of no other method which would allow as efficient treatment of the affected parts as does this form of iontophoresis.

Rheumatoid Conditions. It is now the generally accepted view that the "rheumatic syndrome" includes a great many chronic inflammations outside the joints, with the same pathological changes. Consequently the principles of treatment of chronic arthritis should be well applicable to extra-articular expressions of rheumatic pathology.

Mecholyl iontophoresis was employed in three cases of sciatic neuritis of infectious origin in which diathermy and the straight galvanic current had failed to give relief. They showed full recovery after a treatment period lasting from four to eight weeks. Five cases of brachial neuritis also responded well. Of three cases of bursitis, two made uneventful recoveries while the third proved resistant. In all these patients diathermy had been previously employed.

Although the number of rheumatoid cases treated is insignificant insofar as to permit of definite conclusions, the results obtained suggest that mecholyl iontophoresis should be considered as a hopeful alternate measure when other local therapy fails.

Peripheral Vascular Disease. On the basis of the physiological action of mecholyl iontophoresis, it would seem rational to expect clinical results in cases of peripheral vascular diseases. So far we have treated six typical cases

of Raynaud's disease. Two patients had definite ulcerations, one on the fingers, the other on the toes. In both cases the torpid and painful ulcer promptly healed after a series of daily treatments; at the same time there was other objective improvement in circulation. These cases need further observation during the winter season to determine the permanency of improvement.

Six cases of thrombo-angiitis obliterans were also treated; most of these presented evidence of a secondary spasm aggravating the primary pathological condition. After treatment with the usual technic, the oscillometric readings of two cases, showed an increase of 1 to 1½ points, indicating a definite increase of blood circulation in the limb.

Contraindications. Mecholyl iontophoresis is for obvious reasons contraindicated in patients who show constant elevation of temperature; it is also contraindicated in bronchial and other types of asthma on account of the possibility of slight pulmonary edema. It must be used with caution only in patients with heart involvement.

Conclusions

1. Iontophoresis by choline compounds represents a valuable addition to our therapeutic armamentarium for the local treatment of the rheumatoid type of chronic arthritis.

2. This method also offers a useful alternative for local treatment of other rheumatoid conditions, as myositis, neuritis, and bursitis.

3. The value of this treatment in patients with peripheral vascular disease in which spasm is a factor merits further investigation.

4. The simplicity and safety of application and the effectiveness in the conditions enumerated are likely to bring about a widespread re-employment of electro-iontophoresis in medicine.

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HISTAMINE IONTOPHORESIS IN MYOSPASTIC AND VASOSPASTIC STATES *

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PHILADELPHIA

The possibility of introducing ions into the tissue of the human body by the galvanic current has long been established as a fact. At the moment when electroiontophoresis has apparently reached its lowest level of therapeutic appreciation, its revival was already signified by new proofs of its physiologic and clinical possibilities. Undoubtedly the most interesting finding was the recent demonstration of the clinical value of histamine for the relief of certain forms of arthritis. It is therefore timely to review the nature of this relatively new drug and its effect upon myospastic and vasospastic states.

Nature and Effect of Histamine

Histamine is a biogenic amine which was isolated by Barger in 1907. Chemically it is the methylated ethylamine of tyrosine and is produced from histidine by the loss of carbon dioxide. This change takes place as a result of the action of intestinal bacteria which are chiefly of the colon or typhoid family. The relative toxicity of substances thus formed depends largely upon whether aerobic or anaerobic conditions prevail in the intestines and whether the amino group or the carboxyl group of bodies are first separated. Under certain conditions such products as phenol, cresol, indol, and skatol are formed. These bodies not being highly toxic are absorbed into the blood stream and eliminated by the liver largely as ethereal sulphates.

MacLeod⁽¹⁾ states that under other conditions when the carboxyl group is separated before deamination results, the highly toxic ptomaines come into being. It will be seen that while histamine results from the bacterial action on proteins, the organic chemical steps in its production are rather complicated. That histamine once formed is absorbed through the intestinal wall is proven by the fact that when this chemical is experimentally introduced into the gastrointestinal tract it finds its way into the circulation.

Hanke and Koessler⁽²⁾ believe that the catabolism of histidine to histamine is a protective measure when the reaction of intestinal contents turn to the acid side. There has been much theorizing as to the effect of endogenous histamine upon the physiologic functions, many conditions being rightly or wrongly ascribed to its presence and absorption. Eppinger⁽³⁾ found the base in the diarrhetic stools of infants but never in those of normal children. Roethler reports its presence in the stools of healthy children but much more often in the stools of children suffering with gastroenteritis. Lieb⁽⁴⁾ claims to have benefited insomnia, headache, vertigo, urticaria, and chronic eczema by antagonizing the histamine effect on patients.

The effect of histamine on the secretion of the stomach is too well known to require more than mention. It has a very marked action on unstriated muscle. Indeed, the effect of histamine on the duodenum of the guinea pig is the basis of a delicate test to detect the presence of this agent in very small quantities. Histamine increases gastric peristalsis, contracts bronchioles and pupils, and produces general vasodilatation. It causes marked contraction of the uterine muscle. Generally in toxic doses it causes marked effusion of plasma into surrounding tissues with much congestion of the liver and congestion and edema of the mucous membrane of the gall bladder. The symptoms of histamine shock are very similar to those of surgical shock, and it has been thought possible that the latter state is produced by an excessive amount of tissue histamine being released as the result of extensive traumatization. Histamine can thus be considered as a normal component of tissues which is liberated in excess by such stimuli as injured epithelial cells.

Ebbecke⁽⁵⁾ believes that this agent exercises a hormone-like action which automatically regulates the blood supply to tissues when toxic substances are present. Gaenssler⁽⁶⁾ observed marked dilatation of the capillaries of the thorax after long periods on an excessive

* Read at the Thirteenth Annual Session of the American Congress of Physical Therapy, Philadelphia, September 12, 1934.

¹ From the Medical Department of the Jewish Hospital, Philadelphia, Pa.

and exclusive meat diet. This observer remarked the kinking and dilatation of capillaries under these circumstances and likened this effect to the capillary reaction in histamine shock. Moreover, when vegetables were added to the diet, this observer reports that the above interesting capillary reaction disappeared.

The relation of excessive histamine absorption to the symptom complex bearing the name of anaphylaxis is most interesting. In animals the injection of a heterogenous protein produces many of the signs of histamine shock, such as bronchospasm, enterospasm, peripheral capillary dilatation, localized edema, and tachycardia. In some instances those animals that are sensitive to histamine are also acutely responsive to protein injection. The urticarial and histamine wheals appear identical. The asthmatic patient is frequently sensitive to histamine. Döelkin⁽⁶⁾ reports the production of a typical hemicrania by the injection of one mg. of histamine. As explanatory of the production of dyspnea in histamine shock, it is possible that instead of true bronchospasm an edema of the respiratory mucous membrane is superadded and the difficulty in breathing is therefore produced by a double mechanism. The pharmacologic and physiologic response to histamine in human beings and in animals has been somewhat elaborated in order to lay a foundation for the rationale of the galvanic current to ionize histamine and to thus make possible the utilization of its local effects.

Electro-iontophoresis

The use of an electric current to introduce drugs into the system is not new. Leduc in 1900, worked with such kations as zinc, copper, silver, mercury, and magnesium and such anions as chlorine, iodine and the salicylates. But it remained for a group of European observers, Deutsch,⁽⁷⁾ Trumpp,⁽⁸⁾ Villaret,⁽⁹⁾ Bettman,⁽¹⁰⁾ and others to employ this agent in the treatment of disease by the ionization method. To the writer's knowledge this method has not heretofore been employed in this country. The test of any hyperemia producing method depends upon the agent employed being easily controlled, the extent of its effect on the deeper tissues, and the length of time during which the impression persists. These specifications appear to be well met by the use of either histamine in solution, histamine foils, or histamine salve.

In 1931 Deutsch⁽⁷⁾ reported the treatment by this method of two hundred and fifty patients affected by such conditions as sciatica, chronic polyarthritis, arthralgias, and muscle strain. In the same year Trumpp⁽⁸⁾ reported favorable results with the use of this drug in the treatment of muscular rheumatism, lumbago, bursitis, myalgias and conditions resulting from prolonged immobilization for fractures and dislocations. Villaret,⁽⁹⁾ in 1932, treated Raynaud's disease by histamine iontophoresis, and Bettman believes that this method promises much in the treatment of furunculosis and of ulcerations on the extremities as observed in Buerger's disease and diabetes. Levai⁽¹⁰⁾ and Simanszky,⁽¹¹⁾ in the same year, reported favorable results in the treatment of muscular pain and myospasm with ionized histamine. Encouraged by these favorable results from abroad, the writer has undertaken during the past six months to reproduce these findings by treating such conditions as intermittent claudication, Buerger's disease, diabetic ulcer, arteriosclerotic endarteritis, myalgias, spasticity in spinal cord disease, or injury, and similar conditions.

Technic

The following technic was employed in the treatment of these patients:

A 1:10,000 solution of histamine hydrochloride, i. e., one-tenth gram to the liter, was employed. A glass jar identical with that used in the pathological laboratory for holding specimens was selected as a container. Ten ma. of current for five to ten minutes was employed to ionize the above solution. The positive pole was immersed in the solution and the electrode to which the negative pole was connected was tightly bandaged to the patient's thigh. The surface temperature of the extremity before treatment was taken with a thermocouple, the average of twenty readings being considered accurate for our purpose. These readings were again taken in ten minutes after the cessation of treatment and in several instances at two or three hour intervals following the return of the patient to bed. The temperature of the solution and the temperature of the room were as near as possible that of the part being treated.

Case Reports

CASE 1.—The first patient to be reported is one of Buerger's disease with intermittent claudication. A. B., male, age fifty-nine, first seen June 12, 1933, complained of stiffness and cramps

in both legs on walking as short a distance as one-half a city block. The condition had existed for several months prior to examination. The patient's medical history is essentially negative. He had had no operations or injuries. His father died at the age of seventy-two of carcinoma of the stomach, his mother at the age of fifty-five of cardiorenal disease. The family history was otherwise negative. He exhibited dyspnea on exertion. With the exception of habitual constipation there were no gastrointestinal symptoms. The patient denied venereal infection. He does not use alcohol and smokes five cigars and from five to ten cigarettes a day. He does no manual labor, being employed as a superintendent in a factory.

Physical examination was essentially negative except for moderate sclerosis of the peripheral vessels with some left ventricular hypertrophy. The extremities, particularly the lower, were cold and moist, both lower limbs exhibiting also mild varicosities. His blood pressure in both arms was 145 systolic and 90 diastolic. His oscillometric readings were as follows:

Right ankle 2 Right leg 2 Right thigh 2½
Left ankle ½ Left leg ¾ Left thigh 1½

The histamine wheal test showed a delayed flare and wheal on the left ankle, leg and thigh and a normal reaction on the right. Urinalysis and blood chemistry were normal. A diagnosis of sclerosis and spasm of the arteries of the lower extremities with a thrombotic angiitis was made and treatment with histamine iontophoresis decided upon.

Twenty-three treatments in all were given. After two or three minutes the part immersed in the solution became rosy red in color. It felt full and warm to the patient. The surface temperature of the part was moderately elevated.

Table 1—Histamine Effect on Right Lower Extremity

Date	Before	After
7- 5	29.28	32.80
7- 8	31.30	32.38
7-11	32.59	32.67
7-13	30.41	32.39
7-15	30.83	32.80
7-18	32.26	30.95
7-20	32.60	33.69
7-22	31.98	33.19
Average	31.40	32.61 1.21

Table 2—Histamine Effect on Left Lower Extremity

Date	Before	After
7- 5	29.29	33.55
7- 8	31.27	33.08
7-11	32.24	33.31
7-13	30.98	33.25
7-15	30.91	32.89
7-18	32.30	31.62
7-20	32.43	33.50
7-22	31.42	34.07
Average	31.46	33.16 1.70

The patient on several occasions experienced fullness of the head, similar to that following the inhalation of amyl nitrite. This sensation, however, was fleeting. The blood pressure was reduced from ten to twenty mm. of mercury, systolic and more moderately reduced in the diastolic phase.

Table 3—Histamine Effect on Blood Pressure

Before	After	
	5 Minutes	10 Minutes
148/100	150/105	150/102
130/96	132/100	120/94
130/86	128/86	130/88
130/94	120/92	124/80
130/96	126/90	120/88
150/98	140/100	122/98
126/96	126/98	120/98
140/98	128/100	126/100
130/92	130/96	128/96
134/94	130/94	112/84

The pulse was only slightly accelerated after five minutes and not proportionately increased in ten minutes. No increase in oscillometric readings was noted until almost the end of this course of treatment when at the left ankle the reading was 1½, left leg, 2, left thigh 2½. The right ankle was 1½, right leg 2, right thigh 2½. The patient at the conclusion of this series of treatments was able to walk leisurely one mile and rapidly one-fourth of a mile without cramps. Thirty flexion exercises produced no calf pain. The patient was definitely improved. This result can be partly explained by the relaxation of the vascular spasm typical of intermittent claudication, and partly by an improvement in collateral circulation, which must follow an increase in the total volume of blood in the capillary and arterial fields of the part.

CASE 2.—Mrs. A. P., age 38, presented a persistent hypertension with a moderate kidney, cardiac, and vascular damage. Her extremities and face gave the classical appearance observed in scleroderma with tapered phalanges and tight and shiny skin coverings. Her extremities were cold and blue. This patient received seventeen treatments. The same technic as outlined above was employed, except that the upper extremities were immersed in the solution. The hands after five minutes of immersion became slightly edematous and quite rosy in color. Frequently one or more histamine wheals formed on the dorsal portion of the extremity. Subjectively the patient remarked the presence of a tingling or stinging sensation and stated that her hands "throbbled as if full of blood." This patient at each treatment also complained of certain subjective symptoms, such as dizziness and a feeling of fullness of the head. A marked suffusion of the face was frequently noted, and a definite effect on blood pressure readings was observed, a variation of as high as fifty mm. of mercury, systolic, taking place after ten minutes of immersion of the part in 1:10,000 histamine solution.

7-6-33 Left arm, beginning of treatment: 11 A.M.

	B. P. 200/140
At the end of five minutes.....	160/128
At the end of ten minutes.....	150/114
Right arm, beginning of treatment.....	200/130
At the end of five minutes.....	160/136
At the end of ten minutes.....	180/136

7-6-33 Blood Pressure Readings:

	Left Arm	Right Arm
1:30 P.M.	200/130	190/140
2:30 P.M.	210/130	210/140
3:30 P.M.	210/130	200/130
4:30 P.M.	230/130	220/148
5:30 P.M.	178/138	164/132

In this patient, however, it was noted that hourly blood pressure readings following treatment showed that the vasodilator effect did not persist for longer than two hours. The skin temperature response to the treatment was quite marked as shown in the table below.

Table 4—Effect of Histamine on Left Upper Extremity

Date	Before	After
6-28	29.28	33.59
7-12	29.98	29.82
7-15	29.85	35.09
Average	29.80	32.80 3.00

CASE 3.—Male, age 32. This patient had been diagnosed as Buerger's disease and had received numerous types of treatment. Included therein were sodium citrate and sodium chloride injections, diathermy and postural exercises. On the outer edge of the sole of the left foot was an indurated discharging ulcer. Numerous attempts had been made to heal this ulcer none of which succeeded. Treatment was begun with histamine iontophoresis on June 2nd, 1933. The patient after immersion of the part for five minutes complained of intense burning and fullness of the foot. A considerable cyanosis was present at first, which promptly changed to a hyperemic flush. After seven treatments the discharging ulcer was almost healed but the patient continued his visits to the hospital in the hope that it would still further improve the circulation in his lower extremities. The oscillometric readings of the part before and after a treatment were:

Foot 0, Ankle $\frac{1}{2}$, Below the knee $1\frac{1}{2}$, Above the knee 3.

CASE 4.—M. S., age 32. Diagnosis, spasticity of lower extremities. This patient gave a history of a prolonged gradually lessening motor power in the muscles of his lower extremities. He was a practicing dentist until approximately four years ago, when he was forced to discontinue work on account of his growing disability. He had been very thoroughly studied and had undergone two spinal decompressions in an endeavor to relieve what was thought to be a spinal cord tumor. He presented at the time treatments were begun an inability to walk because of a marked spasticity of both lower limbs. It was decided to try the relaxing effect of histamine

iontophoresis, purely as a means of temporary relief of the spasticity. To this end sufficient histamine was procured to make ten gallons of a 1:10,000 solution. Thighs, hips, and lower back were immersed by placing the patient in a wooden tub and five minutes of a fifteen ma. current was employed. There was an excellent local response, the skin becoming rosy and the spastic limbs appearing much relaxed. The patient stated that he was able to move his limbs through a much greater arc, although this way have been due in part to the ease of movement brought about by immersion. There was no doubt, however, as to the lessening of spasticity. Only slight systemic response occurred. He received four such treatments and this procedure is still being followed. One may not promise, of course, in this case the removal of an affection so elusive and resistant to treatment, but the important fact remains that in conditions characterized by spasm and painful contractions of muscles histamine iontophoresis appears to promise much of value.

CASE 5.—A. K., male, age 58 years, displayed a marked spastic arterial state of his extremities, particularly of the upper. This had persisted for a decade, was characterized by intermittency, and was of such a degree that he was unable to hold a pen when arterial spasm was at its worst. The physical examination was negative except for a compensated mitral stenosis. Even though the rarity of the Raynaud syndrome in the male is conceded, this appeared to be a case of Raynaud's disease. Immersion in the histamine solution always produced a marked flushing of the fingers, the cyanosis disappearing usually in about five minutes, using a ten ma. current. There was often a freedom from further attacks for from 24 to 72 hours following treatment.

A preliminary report of improvement can be made on several cases of hypertrophic arthritis with pain, but the above type of treatment appears to offer a new method of attack in these stubborn cases. As the length of treatment was extended in two instances, a marked but not alarming systematic reaction occurred. In one instance ten minims of adrenalin chloride, 1:1,000 solution, gave prompt relief of dizziness, flushing of face, and mild bronchospasm. It is not apparent, as has been remarked elsewhere, whether histamine produces the latter result by causing an edema of the mucous membrane of the bronchi or the dyspnea is the result of a pure spasm produced by a stimulating action on bronchial musculature.

Comment

The use of histamine iontophoresis in the treatment of cases of the type mentioned above is not new, but not widely used in this

country. By this method we have a means to effect local hyperemia that is easily subject to control. The effect of this vasodilatation in thrombo-angiitis obliterans with intermittent claudication, local ulceration due to a deficiency of blood supply, and in painful muscle cramp or spasm, such as torticollis and lumbago, has been proven beneficial both subjectively and objectively. The ease with which localized areas can be treated by the use of histamine foils or even of gauze pads moistened with a 1:10,000 histamine solution makes possible a local counterirritant effect whenever the use of the immersion method is impracticable. No serious systemic responses were observed even when, as in one case, a fifth of the body was immersed in this solution. This patient evidently was not susceptible to histamine since others in the group displayed systemic symptoms even though the amount absorbed must have been very small. Clinicians have endeavored by the use of systemic vasodilators to procure localized responses. This has proved rather ineffectual, since splanchnic dilatation tended to counterbalance the local effect. It would appear that by the immersion method the physician has at his command a means by which effective treatment can be given to such conditions as diabetic ulcerations of the extremities, Raynaud's disease, Buerger's disease and many others of the vasospastic endarterial group. The writer has not been able to learn how rapidly a known strength of histamine solution decreases in concentration as the result of ionization. It is reasonable to suppose that after several treatments, a 1:10,000 solution may easily become so weakened that it has but a fraction of the original strength. It has been repeatedly noticed that after three or four treatments local and systemic response tends to become less, and that these reactions recur when a fresh solution is employed.

Conclusion

1. Histamine iontophoresis has not hitherto been employed in this country to the knowledge of the writer for the purpose outlined above.

2. Histamine lends itself to intradermic absorption and the production of local vasodilatation by the ionization method.

3. Favorable response to treatment was secured in a number of cases in which the basic difficulty was a local ischemia due to a vaso-

spasm or due to a deficiency in collateral circulation accompanying an obstructive lesion.

4. The relaxation of painful muscle spasm and the production of a localized counterirritant action appear to offer an additional therapeutic measure in the treatment of these conditions.

5. The use of this agent by the methods outlined is not advocated as an infallible cure-all to be employed recklessly.

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Discussion of Papers by Drs. Richard Kovács, Joseph Kovács and Joseph C. Doane

Dr. Irving Sherwood Wright (New York): Like iontophoresis, the use of electricity in various forms for the treatment of peripheral vascular disease is not new. Under case number seven in Raynaud's Original Thesis, "Local Asphyxia and Symptomatic Gangrene of the Extremities," there is a description of a patient, suffering from a condition which fits in with our modern conception of Raynaud's disease, who, it

is stated, was treated with improvement by Duvall with induced electricity before 1859. The type of current used is not specified, and no drug was associated with the treatment. As stated by the Doctors Kovács, the more or less dispute into which iontophoresis had fallen made all of us working in the Vascular Clinic at the New York Post-Graduate Hospital extremely skeptical, first, as to whether an appreciable amount of any drug could be absorbed through the skin by this method, and, second, whether a therapeutic effect could be obtained when this method of inducing a drug was used. In order to satisfy myself, I had Dr. Joseph Kovács use a bifurcated cable to my arms, using the same current but saline for one arm and Mecholyl (formerly known as Mecholin) for the other. The physiological effects were precisely as described in the authors' presentation.

I have had the opportunity of observing in detail the vascular patients and a few of the arthritic patients in this series. Although it is still early to speak of permanent results, the temporary improvement in many of these patients has been most marked, and there have been encouraging effects lasting over many months in certain individuals.

I wish to emphasize that we are dealing with an extremely powerful drug and one which is not free from danger when improperly handled. This is especially true following its hypodermatic use, but we should observe certain precautions when using it by iontophoresis. As an example of the profound general effect obtained, Dr. A. W. Duryee, working in our clinic, has noted a basal metabolic increase from 0 to plus 55 in one patient, and from plus 4 to plus 34 in another, during a single treatment. This increase rapidly subsided to normal on cessation of treatment. The electrocardiogram also shows marked changes in the form of increased voltage. Salivation may be most marked, even though the drug be applied to the calves. We have had as much as 140 cc. of saliva secreted during a treatment.

As indicated by the essayists, certain diseases constitute definite contraindications to its use, and I am inclined to include old or recent coronary occlusions in that group. Although we might except vasodilation of the coronary tree, these patients usually begin to complain of tightness and anginoid symptoms shortly after the onset of the treatment. On the basis of our basal metabolism, electrocardiographic and pulse increases, I feel that we must acknowledge that the increased burden placed on the heart muscle probably demands more blood than the dilatation produced affords.

I should like to mention two instances in which severe and troublesome burns have occurred when the application of the solution and positive electrode was made over small bits of adhesive tape fast to the skin. There have been similar instances without the production of a burn, but it should be borne in mind. Acetyl-beta-methyl-choline-chloride should never be administered by any route except in the presence

of readily available atropine which will immediately counteract its effects, and hence acts as our greatest safety factor in the use of this drug.

In conclusion, I should like to remind you that the choline derivatives and allied drugs constitute a great addition to our present therapeutic armamentarium; that only a few of the drugs from this group have been studied pharmacologically and used clinically; that these do not represent perfected drugs for clinical use from several viewpoints. I venture to predict that, in the next few years, many other members of this group will be tried, and it is probable that more satisfactory ones will be utilized before the ultimate is obtained.

Dr. Frederick H. Morse (Boston, Mass.): The fundamental electric principle is so well understood by most of the members of this association that we can readily understand Dr. Kovács' enthusiasm over a new drug for ionization. For many years, many drugs have been experimented with, with the idea of using them for driving the drug into the skin for local relief and medication.

Cataphoresis is not ionization; it is purely a mechanical operation. Many years ago when we attempted the use of cocaine, I was able to drive in cocaine over an abscess, and perform a surgical act without any pain. That was pure mechanical action, that of propelling an electro-positive alkaloid toward the negative pole.

We know the opposite action of the two poles. It has been disappointing to most of us who have attempted to use alkaloids, iodides and sulphates, and different medicinals by electrophoresis in arthritic conditions to find them clinically inefficient. We know that when iodine is introduced on a moist negative electrode and this placed in the rectum, or the vagina, and the positive pole on the neck, immediately it will take the iodine stain. That shows that the mucous membranes are very susceptible to ionic medication. Therefore, in the ear, nose and throat, vagina, even the rectal cavity, we can provoke ionic medication with zinc, copper and sometimes silver. Thus we can control our medicinals and other substances by means of either pole. This method has a special and more constructive action where we wish to treat a granulated surface.

The essayists have brought to us today a new form of medication, a new drug with which we are not familiar. In arthritic conditions it seems not only to give local relief but has a systemic effect which bears watching.

Claim is made that they have noted a diminution in the amount of the drug in the solution after a few minutes of application. This is valuable because there we know its limitations and we should not be too careless, yet not too cautious, otherwise we will not get results. I should judge from the descriptions given that we have something that is valuable and something with which we should be better acquainted.

Diathermy has become almost universally adopted as the ideal apparatus for the administration of the heat. Where we cannot place the electrode in such a position as to attack

the arthritic point directly, negative galvanism has always been our strongest weapon. We localize it in that way and get an increased solvent action in respect to the diathermy.

When we are treating an infectious arthritis, we have to treat the focal point of infection, and if we are treating a traumatic arthritis, with no focal point of infection, then the doctor's paper of today is extremely valuable.

There is an element of truth behind his principle in the way the drug is deposited. There is no guesswork there. In the galvanic method, when properly applied, we have a more definite weapon than all the others put together.

Dr. William Martin (Atlantic City, N. J.): I have never used either one of the chemicals that have been mentioned here, but I have gone along the old lines of therapy. I have, of late years, used diathermy for the treatment of the conditions mentioned, and as an adjuvant, the static current. I have obtained fairly good results. I would not say that I have ever obtained 100 per cent results.

The introduction of these vasodilating agents, however, permits me to think that there is a possibility of our going back to ionic therapy, from which we may obtain a great deal that is of value, with fair if not excellent results. In regard to the concomitant symptom of pain found in most of these arthritic conditions, I have found that the application of the static wave current following the diathermy has given me most excellent clinical results.

While I have not a complete record of my cases, because of the transient character of my patients, yet those who have cooperated long enough have obtained results of a satisfactory nature.

Dr. L. G. Roundtree (Rochester, N. Y.): I have been interested for a great many years in the treatment of chronic arthritis, also in the treatment of peripheral vascular diseases. There exists a great need for methods which would enhance the circulation in these diseases.

Personally, I have always believed that in chronic arthritis a local ischemia was playing at least some rôle. The evidence which Dr. Kovács brought in, is in my opinion, adequate, there is a change in the circulation. This change seems to be very considerable and lasts for a long period of time. If this proves to be true with this drug in the beginning, then it is likely to be true of other drugs that can be devised which can have still further action in this direction.

My own belief is, after years of study of the treatment of arthritis and peripheral vascular diseases, that this does offer something very definite in the way of improvement over what we have. We can judge that, not only from what has been said, but from Dr. Kovács' enthusiasm of the treatment and the results obtained.

Dr. J. Urdang (Brooklyn, N. Y.): In Dr. Doane's paper he mentioned the treatment of thrombotic angiitis, or the endospastic conditions, citing one case of ulceration. I wonder if he would give us a little more detail as to the effect of the histamine in those cases of thrombotic angiitis that have already reached the point of spontaneous amputation of one or two toes with the accompanying gangrene of the other toes or parts of toes. The main element there is the one of pain. I was wondering if he could dilate a little further on the effect of the histamine in controlling the pain as well as overcoming the gangrenous condition and increasing the rapidity of healing.

ELECTROSURGERY AND THE TONSIL PROBLEM *

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The status of fractional removal of the tonsils by electrosurgery has changed in the past few years. Five years ago, the issue was confused by the optimist who claimed electrocoagulation of tonsils was a panacea for all tonsil troubles, and by the pessimists who declared that the method had no value at all.

At present, many believe that tonsils can be completely and efficiently removed by electrosurgery. The work of Hollender, Strauss, and others in the middle west, and Skillern;

Silvers, and Dillinger in the east, has demonstrated that electrosurgery is a rational procedure in selected cases for tonsil extirpation.

To say, however, that electrosurgery has solved the tonsil problem, would be far from the truth. In the first place, no single form of operative procedure in itself will ever solve the tonsil problem, although it is true that improvement and changes in operative methods and technic ultimately will bring better results. The ability and experience of the operator always will determine the success of the operation. In spite of our preference for

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good surgery in the large majority of patients who present themselves for tonsil removal, there is, in my opinion, a small group of patients for whom electrosurgery has solved the tonsil problem to some extent. In this class comes the elderly patient, the hemophiliac, and the patient with a retarded blood or slow clotting time; the tuberculous, the individual with hypertension, and the cardiac. Electrosurgery has also served as an ideal means by which tonsil remnants can be adequately destroyed.

I was one who early employed electrosurgery for the removal of tonsils. As a result of seven years experience, I feel free to say that in my hands it has proved to be a useful, practical and successful method in selected cases. These comprise approximately ten per cent of all cases that come to me for tonsil removal.

So far as the end results of surgery and electrosurgery are concerned, the two operations are capable of giving the same end result — the complete removal of all tonsil tissue. After inspecting the throats of two hundred patients in which the tonsils were removed by electrocoagulation at least one year after completion of the operation, I found lymphoid tissue present in only four patients. Three of these were among the first twenty-five patients operated upon by this method. The fourth patient, living at some distance, was not seen again after the last treatment, until eleven months later. It is my practice to see every case several weeks and also several months after the last treatment. If, at such time, any tissue remains, it is extirpated by the usual means.

Cautions in Technic

The technic of electrosurgical tonsillectomy has been given by every writer on the subject. I shall omit this phase, but I do wish to emphasize the fact that, unless the fractional technic is utilized, the procedure defeats its primary purpose. The early advocates of the one-step operation now fully appreciate the fallacy of such a method, and nearly all of them have changed to the fractional technic.

I have briefly indicated the class of patients who make desirable subjects for electrosurgical removal. Even many of these can be done by surgery, and unless there are other factors which influence the situation, surgery is to be preferred. In those patients who finally

come to the electrosurgical operation, caution must be exercised in avoiding some of the possible difficulties which may arise with any surgical procedure. Chief among these is primary and secondary bleeding. I have on several occasions observed other workers whose faulty technic led to unnecessary primary bleeding because they were unfamiliar with the correct set-up of the high frequency machine. The current strength was insufficient for good coagulation, as a result of which trauma with the needle electrode produced bleeding which was not easily controlled. Secondary bleeding is not always preventable, but experience has demonstrated this too can to a large extent be avoided by limiting the amount of coagulation performed at a single sitting. Over-coagulation, especially in the depths of the tonsil, subsequently permits of large premature sloughs which break off, leaving denuded surfaces that bleed easily on the slightest provocation. It is extremely important to guard against these occurrences, as failure to do so brings criticism on the method, which, in experienced hands seldom is subject to these difficulties.

Secondary Operation

The occasional imperfection of surgical tonsillectomy has left room for electrosurgery as a suitable aid. I have reference to the destruction of "stubs" and remnants of lymphoid tissue, for which even those who are opposed to electrosurgery are agreed that the method serves a most useful purpose. It is not an uncommon practice to be required to perform secondary operations on the tonsils. Many patients utterly refuse to submit to surgery the second time, and for them electrocoagulation offers the best substitute method which has been advanced in recent years.

Not infrequently, large lingual masses of lymphoid tissue fill up much of the tonsillar fossa after the faucial tonsil has been removed. This occurs especially in the so-called lymphoid type of individual, but may also result from incomplete tonsillectomy. Many specialists are opposed to removing the lingual tonsil at the time of tonsillectomy, only to observe later a compensatory hypertrophy of this structure. This sort of a situation has always presented a difficult problem, particularly, if the tissue was infected and the patient has a secondary systemic disease which might be due to focal infection. The facility with which

electrocoagulation functions in such cases as these speaks most favorably for the method. In such instances, too, the superiority of electrosurgery over surgical excision cannot be doubted. Once again it should be mentioned, however, that correct technical application spells success, while faulty application will result in failure.

In a comparatively large series of cases, for which secondary operation was found necessary, I was able to completely remove the remaining lymphoid tissue in from four to eight treatments without necessity of hospitalization, and without immediate or subsequent complications. Improvement in the general condition of the patient was a noteworthy observation. In another series of cases in which surgery was employed for the removal of remaining offending tissue, the end-results were likewise favorable, but the disadvantage of marked bleeding in some patients when the lingual tonsils were removed definitely pointed to the superiority of electrosurgery for this purpose. The added necessity of hospitalization, impaired nutrition after operation and loss of time from work are other factors, which to the physician may appear trivial, but to the patient are important considerations.

In this connection, also, I have found electrocoagulation of value in reducing and destroying lymphoid masses which not infrequently occur as a result of postnasal infection and are found on the posterior pharyngeal wall. Even though the infection is cleaned up, the masses persist causing much irritation, and sometimes hawking and coughing which cannot be controlled by medicinal means. Electrocoagulation puncture soon shrivels up these masses and relieves the symptoms.

Comparison of Methods — Anesthesia

It is doubtful whether marked superiority exists in the comparison of one electrosurgical method over the other. The single needle electrode and the two needle electrode produce the same ultimate effect — destruction of tissue. The claims that the two needle electrode advocated by Haiman of New York, and others, causes less discomfort at the time of operation because of the need of a current of less milliamperage has not been borne out by experience.

Doane's technic, in which he utilizes the retractor for the dispersive electrode, possesses only the advantage of convenience. Here, too, a lesser current strength is required. Discomfort is complained of by some patients, irrespective of the method and the anesthesia employed. I have come to the conclusion that the patient's reaction is largely an individual factor. Mental attitude and particularly, apprehension, have much to do with a patient's reaction to any medical or surgical treatment and doubtless play a role here.

The subject of anesthesia has been discussed on numerous occasions. Many of the synthetic preparations have been tried for topical application. A preparation often found satisfactory in the hands of one specialist, is unsatisfactory in the hands of another. Cocaine solutions in various strengths are preferred by some.

I have found that two factors play a good part in the effectiveness of the anesthetic. One is adequate painting of the area, and the other is time, i. e., waiting five to ten minutes after the final application. The tendency of performing coagulation without careful attention to these factors is often the reason why patients refuse to continue with the operation after the first treatment.

Comment and Conclusions

In this discussion, I have attempted to present the facts concerning electrosurgical removal of the tonsils. I have also pointed out some of the disadvantages of the method as well as the advantages. The indications for the procedure are far from conclusive, but on the basis of considerable work done thus far, certain indications appear quite definite.

Whether the choice of a method plays a part in the end-result is problematic, although it must be admitted that a correct technical application is paramount to success.

In my opinion, the method should not be attempted by anyone who is not thoroughly familiar with surgical tonsillectomy. While the latter is undoubtedly the procedure to be preferred in the greater percentage of patients presenting themselves for tonsil removal, electrosurgery has its place as the best available substitute method and as the ideal means of secondary operation.

CANCER OF THE HEAD AND NECK *

A Critical Analysis of Available Therapeutic Methods

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Electrosurgery

Surgical endothermy, the product of an electrical era, has come into our armamentarium within the last few years. It is already strongly entrenched, for it possesses many advantages when used in the dissection and destruction of malignant tissue. For sterilization of tissue and for reducing the danger of metastasis in the course of surgical procedures it has also proved its merits. Followed by radiotherapy, diathermic destruction has a field of great usefulness⁽²⁸⁾. The value of surgical diathermy is enhanced because it provides nearly a bloodless procedure during the operation. The coagulating current seals off the vessels and thus lessens the risk of recurrence and extension of the growth. Moreover, with the improved armamentarium, the process is rapid and clean. There is little or no shock. The disadvantages, namely, that it is not selective in its destructive action and that there is danger of secondary hemorrhage are not sufficient to outweigh its general usefulness. Occasionally there is observed, however, extensive sloughing with severe pain and toxemia. Before electrocoagulation of large masses of tissue is undertaken, the larger blood vessels must be tied off if accidents are to be prevented. In managing tumors of the pharynx ligation of the external carotid should be a preliminary measure.

In treating carcinomas of the pharynx, base of the tongue, epiglottis and oropharynx, I have used surgical diathermy together with block dissection, which implies the thorough removal of all the lymphatic-bearing tissue draining the region of the growth⁽²⁹⁾. Electrocoagulation is then employed to seal the entire area laid bare by this mass dissection. In the oropharynx such operations are of some magnitude and very often the type of procedure must be designed to fit the exigencies of the moment. As it is difficult to judge the

extent of the involvement, one should work wide of the growth at all times. Lateral pharyngotomy, which has given good results in some hands, has proved with us to be an operation of high mortality⁽³⁰⁾. In malignant lesions of the laryngopharynx and esophagus, surgical intervention, x-ray and radium, alone or when used in combination, have been unsuccessful procedures. A great deal remains to be done in combating malignant tumors in these areas. To us gastrostomy, early, is a humane procedure which permits of any type radical therapy thereafter.

Epithelioma of the external ear, when seen early before cartilage, external auditory canal or surrounding areas of the ear are involved, is primarily a problem of irradiation and conservative electrosurgery. When extension to the deeper structures takes place, nothing less than radical treatment (surgery and electrosurgery) is indicated to attain a cure. External ear carcinoma is usually of a squamous variety with the basal cell type next in frequency. Irradiation, to be adequate, may cause considerable difficulty due to the lack of resistance of an avascular aural cartilage to a perichondritic process. The deformity which may ensue defeats the very intention of producing a cure and yet maintaining cosmetic end-results. In most instances good technic can deliver the proper and safe dosage. When conservative therapy has failed radical attack by means of surgery and electrosurgery, widely removing the auricle and other involved structures is justifiable. A preliminary ligation of the external carotid should precede such an attack. Then, postoperatively, x-ray may be used.

The problem of carcinoma of the external nose is not unlike that of the ear. Those occurring on the nose are practically all of the basal cell (Krompecher) type which respond very well to irradiation. Where the technic has been inadequate or unavailing and the deeper structures involved, no compromise short of radical treatment should be adopted. Such local parts lend themselves to electrosurgical

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resections wide of the involved areas, to be followed later by irradiation. Conservative eradication with cosmetic results in mind has too often resulted in local recurrence.

With surgery, electrosurgery and irradiation combined, we have had excellent results in the treatment of malignant tumors of the nasal sinuses, especially those of the antrum. Quick's⁽³¹⁾ experience of 83 per cent of inoperable cases in malignancy of the sinuses and nasopharynx would express our own experience. Quick recommends combining radium implantation, roentgen ray, radium packs, and surgical removal of glands but claims that surgery is contraindicated in radiosensitive types of tumors. I have not found radium in itself satisfactory because of the difficulty of access to these growths and the resultant inflammatory changes which complicate the picture and the treatment. When the soft tissues of the cheek, including the skin, are infiltrated they are likewise removed. This permits inspection of the cavity over a period of months or years, thus facilitating the attack on any suspicious granulation tissue. Exposed osseous structures are slow in healing and oftentimes bony sequestra separate after many months.

I might again, at this point, refer to the transitional types and the lymphoepitheliomas which respond so well to x-ray therapy. We have found them to be of a highly malignant character almost melting away under therapy, only to come back stronger than before, responding with less sensitiveness to the irradiation or not at all and ultimately leading to death. The regression is most impressive, but the recurrence thereafter is remarkable for its rapidity; then becoming radioresistant. From such experiences, it can be concluded that the x-ray dosage was interrupted for too great a time and that for all practical purposes such types (and perhaps all carcinomas as well) should be given exposures as continuous as possible, getting in the greatest dosage, if a cure is to result. Our method of attack in sinus growths has been by radical electrosurgical resection, going wide of the growth, including osseous structures and at times the orbit and its contents, and block dissection of the lymphatic-bearing tissue of the neck. Here again ligation of the external carotid is essential. The surgical removal of the parts is followed by the searing of all the structures with electrocoagulation. The x-radiation is

applied both preoperatively and postoperatively; radium is placed in the cavity, delivering upwards of 2500 millicurie hours. Cosmetic results are not allowed unduly to influence our procedure at this time. If mutilation results, plastic reconstruction can be successfully performed. The rehabilitation of the patient is, of course, an important item.

It is the belief of most laryngologists that intrinsic laryngeal carcinoma is primarily a surgical condition. This is said mainly because of a tendency on the part of certain clinicians to advise solely the use of radium or x-ray in such types⁽³²⁾. I am well acquainted with cases which have been reported as cured, but in which death from recurrence or metastasis has occurred⁽³³⁾. Many cases have been reported too early and some have been accounted for as cured, because the primary growth had cleared up. One should be cautious of the claims made for these agents. Preliminary reports should be discouraged unless followed later by final reports. It is the latter which would greatly change our premature encouragement. According to a recent statement of Coutard⁽²³⁾, in the larynx, more than any other site, some cancers are easy and some are difficult to treat. He feels that when the growth has only slightly immobilized the muscle and as yet not invaded the cartilage, x-ray therapy is relatively easy. The radioresistant cancers of the larynx have not yielded to treatment despite heavy dosage. In addition to a negative response accidents are common. I have never found any other type but a squamous cell carcinoma in a larynx and have seldom been so fortunate as to see that ideal case which is chosen for radiation. Such cases have readily responded to the less radical types of surgical interference. Laryngeal cancer to Coutard is a surgical condition, despite an experience in 77 cases of 28 and 27 per cent cures after 5 and 7 years, respectively, only when it has invaded muscle and cartilage. I am certain that most laryngologists would not deem it wise to accept such cases for even radical surgery.

Traditionally, time is an element in favor of surgery and perhaps with the lapse of years and the development of a technic, irradiation will be in greater demand. Caution must be exercised in favoring a method solely because it is conservative. In our hands laryngofissure plus radium or electrosurgery has given poor results, al-

though thyrotomy and hemilaryngectomy have given excellent results as shown by statistics of Thomson, Jackson, New and others. Epiglottis carcinoma may be removed by diathermy; growths at the anterior third of the cords, by thyrotomy with excision and coagulation; laryngectomy, if the growth is highly malignant and more extensive, and pharyngotomy for lesion of the vallecula, base of tongue, aryepiglottic fold and post-cricoid area. The endolaryngeal procedures have been disappointing except in early cases. I have used electrocoagulation by direct laryngoscopy and through a window made in the thyroid cartilage on the side of the involvement. The window is a dangerous procedure in that it breaks down a natural barrier to the further progress of the tumor by extension. In our experience, radium in laryngeal carcinoma has proved to be an ineffective therapeutic agent. This is clarified by Coutard's definition of what constitutes a favorable case but at present we can say that while the element is far from satisfactory, it is not useless in laryngeal carcinoma.

The types of involvement in which the region affected and the extent of the mass bring them into the class of cases that are too late even for radical treatment, we call inoperable, but the term *ineradicable*, given them by Mackenzie⁽³⁴⁾, is more appropriate. Approximately five out of every six cases which I see in my clinic are unfortunately of this type. They are cases in which the growth has involved the base of the tongue and extended down toward the vallecula; in which the glosso-epiglottic fossa, the laryngopharynx or introitus laryngis is involved; cases in which the mass of glands becomes fixed and includes the cellular tissues of the neck; where the disease has extended to the mandible, the esophagus, the vertebrae; all cases, finally, in which the involvement is so great that even if eradication were successful, it would leave life too difficult to carry on, with the inability to re-establish function even in part.

It is well to remember, when we speak of glands, that glands in the neck are not always secondary malignant manifestations, especially those that are discrete and small. For example, in the large majority of cases of carcinoma of the tongue and floor of the mouth, the salivary glands that can often be palpated are not the seat of carcinoma. The enlargement is frequently of a chronic inflammatory

nature, apparently due to infection carried along the ducts from the mouth⁽³⁵⁾. One might, therefore, feel justified in leaving the submaxillary region alone; but clinical experience teaches us that subsequently this area readily becomes the seat of metastatic extension. The glands that make a case ineradicable are those which are matted together and so extensive that removal, even *en bloc* would be futile. In not one of such cases of glandular involvement, even of the discrete types which existed at the time of treatment, and which we have observed for a sufficiently long period, are we able to report as cured. And we are somewhat skeptical in claiming that we prolonged life by such interference.

The physical triad may be applied as palliative measures in inoperable and also in ineradicable cancer. I have seen good results from x-ray and radium when no other form of treatment could be used, and certainly life seems to have been made more comfortable by the irradiations. It is in such cases that chemotherapy and serotherapy have been of value in bringing about diminution of pain and in some cases reduction in the size of the tumor⁽³⁶⁾. Something must of necessity be done for these types of cases, but we certainly do not recommend the tremendous x-ray and radium dosages that are often advocated. We must remember that what we seek in these cases is the alleviation of suffering. We must beware of adding anything to the misery of these unfortunate patients. I have tried many of the palliative measures that have been mentioned, because in this deplorable condition it is humane to go on trying, despite the odds, and we are rewarded even if slight relief is obtained. In this respect, radium and x-ray have proved of great value in many cases but the spirit in which they are applied should not be merely for the sake of doing something. Life has undoubtedly been much prolonged, and, what is probably more important, the irradiations have enabled the patients to pass this added span of life in a state of comparative comfort.

Surgery

Only slight advance in the purely operative side of malignant disease has been made in the last decade. Radical surgery has not been resorted to any more than it was years ago. There are, of course, a number of newer measures which are employed in addition to

accepted surgical technic, but the general principles of treatment still prevail. If we can write anything of a noteworthy character in the annals of surgical advance, it is in regard to total laryngectomy in intrinsic carcinoma of the larynx⁽³⁷⁾. After many years of failure in a large number of cases, due to infection, secondary hemorrhage, postoperative sepsis and bronchopneumonia, this very formidable procedure has reached the stage where the percentage of failure has been reduced to almost a negligible figure. Alertness on the part of the profession in recognizing the importance of persistent and progressive hoarseness, especially in a person after middle life, has led to earlier recognition of malignant lesions. Direct and indirect inspection of the larynx have enabled physicians to detect a growth which is usually located on the middle third of one cord and is of a non-demarcating nature. By excluding syphilis, tuberculosis and other likely causes of chronic hoarseness the diagnosis of carcinoma can be made clinically with a reasonable certainty. Simpler methods of direct laryngoscopy in the last few years have permitted earlier and perhaps easier accessibility for the removal of tissue for microscopic study. Roentgenologic observation of the laryngeal structures has likewise enhanced our knowledge of the progress of neoplastic invasion. All these factors, in addition to improved operative technic and a better interpretation of the operative risk, have contributed to the success of laryngectomy.

The pessimistic outlook attributable to the earlier tremendous operative mortality in laryngeal surgery, must give way to modern management of carcinoma of the larynx. Many of the laryngofissures, thyrotomies and endolaryngeal procedures that are performed are the result of fear of the severity and mutilating effect of total laryngeal extirpation, the latter being reserved for more marked involvement. Timidity on the part of the profession is also shown in emphasizing the loss of voice (which under any circumstances is possible) as an important sequel of the operation, as though this is a grave matter compared with the loss of life itself. The most incipient cancer of the larynx should be treated by no other method than the most radical. This statement is made in full appreciation of many reports of cures by the more conservative measures of thyrotomy or laryngofissure⁽³⁸⁾, and as far as trying the less radical

first, the futility of secondary operations is only too well known. "Any method other than laryngectomy is in direct violation of the principles one would follow in attacking cancer elsewhere in the body, since this site certainly offers every opportunity of getting wide of the growth, when the lesion is attacked early." (MacKenty.) For any fair degree of success along such lines, cases must be well chosen; borderline cases or extrinsic laryngeal involvement have been uniformly operative uncertainties.

By combining surgery and electrosurgery, large growths can be removed, rendering the area more accessible for direct irradiation. Invaded bone, which is radioresistant or devitalized bone, can be removed surgically, the cavity coagulated, and radium or x-ray applied. One must not place dependence on radical surgery alone as only too frequently recurrence of the growth occurs. Planned "mass attack" is the only practical way of meeting the situation.

Anesthesia

A subject which has for years been of great interest to us is the problem of anesthesia. Our attention has been directed chiefly on the rectal administration of anesthetic agents primarily because this method greatly facilitates the operative procedure by avoiding the necessity of an anesthetist and his conflict in the head area. Another reason for avoiding the use of general anesthesia is the current use of electrosurgical apparatus at the time of operation. While accidents are not common, the possibility of this hazard is obvious enough to have it in mind. Local and rectal forms of anesthesia should be employed wherever possible. Some time ago we published reports on synergistic analgesia⁽³⁹⁾, in which these requirements were met in form of an ether-olive oil mixture, per rectum, and a morphine sulphate and magnesium sulphate intramuscular combination (Qwathmey). During the past five years we have been using tribromethanol (avertin)⁽⁴⁰⁾.

Rehabilitation

Plastic Repair. As was previously stated, in our attempt to eradicate a malignant area, no thought of cosmetics should be entertained. Complete or partial resections of parts have for years been cleverly repaired and reconstructed by flaps, grafts, etc., after it is certain that no recurrence is present.

There has been much published showing excellent results for the surgical efforts. While general surgical principles hold, each patient presents an individual problem which requires much study on the part of the surgeon. Such plastic endeavors have often been confined to institutional types of cases because of the economic problems involved. Since the skin cannot be moulded in the manner of clay, operations are time-taking, involving great economic loss and much suffering on the part of the patient; the results too, are often unsatisfactory. Those engaged in this type of reconstructive surgery appreciate these facts and know precisely how arduous is the task of cosmetic rehabilitation of parts.

Prosthesis. A section of our subject of rehabilitation, on which I will touch but briefly, is the replacement of parts sacrificed in the removal of diseased tissue. The deformity can oftentimes be taken care of by operative plastic repair after one is positive that there is no cancer recurrence. Sometimes the defect is so great as to make surgical repair not alone difficult but impossible. Furthermore, it quite often occurs in older individuals that it is not feasible to subject them to further operative procedures. The prosthesis is offered as a substitute and in some instances, in preference to extensive surgery. Since 1925, I have been utilizing a form of rubber material, light and flexible, and made to resemble the color of the patient's own skin⁽⁴²⁾. The method is practical, economic and certainly offers a good substitute for external reconstructive surgery. Prosthesis of this character has the additional advantage in that it enables the surgeon to keep the affected parts under repeated observation.

Development of Speech. The sentimental attitude that has existed in previous years in respect to voice deprivation in laryngectomy, should not exist today in the face of the facts that have been stated. Furthermore, the voiceless person may be helped by an apparatus; he may even be taught to speak without a larynx⁽⁴¹⁾. We have been most agreeably surprised at the readiness with which patients take to the latter method, avoiding the conspicuous if not unnatural sounding artificial larynx. All patients, of course, learn by intuition the method of speech which we ascribe to a gastro-bucco-esophageal phenomenon, but not all develop intelligible speech. Some very brilliant results are obtained in this

direction; these due mainly to the personal energy and persistence of the patient in systematic efforts in perfecting this type of speech. The development of a simplified artificial larynx makes the problem even less difficult for some laryngectomized patients. A number of inexpensive but effective larynges are available.

Centralization and Education

The entire cancer problem suffers from a lack of centralized effort. An institute of established reputation, working under one head, could concentrate and coordinate the efforts of investigators in the various fields. Such an institute can offer better therapeutic possibilities and provide for a more thorough statistical control. A cancer center should be started in every metropolitan city to handle the cancer situation within it and its surrounding country. Large institutions such as our state universities have within their power, the ideal functioning toward a definite objective through the cooperation of the various clinical departments, facilitating early diagnosis, expert tissue interpretation by the pathologist, technical advice by the biochemist and physicist, and finally, surgical interferences by the various special departments when indicated in selected cases (Fig. 6). Institutions of this type should be opened to physicians as well as to the lay public in order to direct propaganda and stress prevention. Such cancer institutes should have provisions for the care of private cases under the supervision of their own physicians who could be kept in close touch with modern thought, and in particular with modern diagnostic methods and treatment of cancer.

At the University of Illinois College of Medicine, we have made a concerted effort to teach the subject of cancer by having all departments organize tumor clinics and work under the plan suggested. In addition, we are attempting to inculcate in our students current knowledge of cancer but, in particular, the importance of its early diagnosis and treatment. In regard to the latter, we convey to the student an appreciation of the values of the different therapeutic methods in the various stages and types of tumor development, and other major considerations. There undoubtedly has been aroused greater interest in the cancer question by the laity, and as in tuberculosis, it may eventually lessen the mor-

IDEAL PLAN FOR THE CENTRALIZATION OF EFFORT IN COMBATING MALIGNANCY

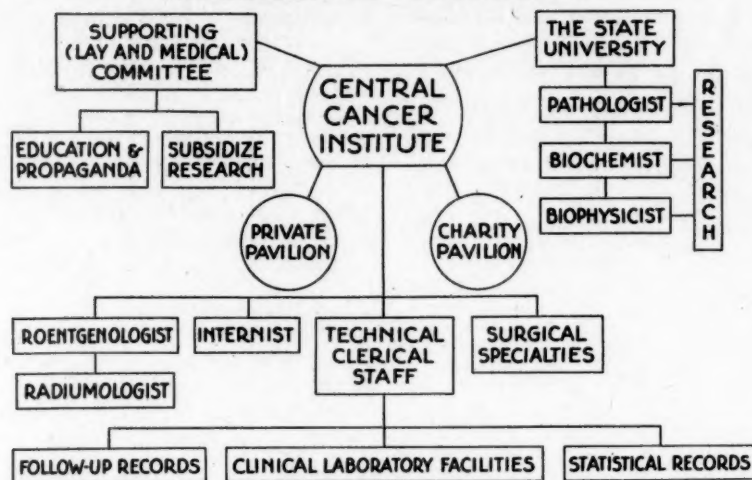


Fig. 6. The ideal attack on the cancer question is by a concerted communal effort. This plan should function ideally in every large city and especially in conjunction with an established institution. Reduplication of effort and economy are thus effected.

tality of this dreaded malady if not its incidence. This depends largely on the study of the causative factors involved and a stronger emphasis on early diagnosis. The former is being attacked vigorously from all angles of research, and the latter is dependent upon the proper teaching of students and physicians in modern diagnostic methods.

Conclusions

1. The literature requires much "sifting" regarding the cancer problem. Greater strides are recorded in treatment because of the advent of physical destructive agents.

2. The tremendous increase in cancer for those under 40 disproves the adage that "Cancer is a disease of old age." Statistical information is influenced by too many factors to be adequate.

3. It is speculative to suggest that such factors as mode of living and better methods of diagnosis may account for the increased number of cancer cases.

4. Mouth and dental hygiene are observed to be universally poor in our experience. Smoking and voice abuse are remote factors.

5. The clinical index of malignancy is dependent upon the location, duration, rate of growth, the metastasizing quality of the lesion, age and previous treatment of the patient. The evaluation of this index governs the prognosis and treatment.

6. Biopsy for diagnosis is imperative before

taking the responsibility of advising any form of therapy.

7. The absolute reliance upon the histologic type of cellular activity is questionable. The anatomical location and the factors included in the clinical index must be considered to determine the course, prognosis and therapy.

8. Malignant growths about the head and neck, apart from the usual problems involved in the treatment of cancer, offer certain special difficulties due to their exposed location and involvement of sense organs. The cosmetic results, loss of sense of sight and of speech, are major problems.

9. An "open mind" must be kept with regard to chemotherapy and physiological agents until more is known about the etiology of cancer.

10. The site of the tumor may prevent early recognition and place an otherwise operable carcinoma into an inoperable class.

11. The physical methods are logical adjuncts and oftentimes the only measures in the successful conduct of the cure of cancer. Cases must be individualized. Cost is important, if a method is to be made available to all.

12. The tendency to standardize technic in the same ratio as the diagnostic effort is responsible for the progress which is being made.

13. Apparently "inoperable" cancers about the head may sometimes be successfully treated.

ed by combining the use of physical measures and radical surgery.

14. Surgery (laryngofissure and laryngectomy) is the method of choice for carcinoma of the larynx as shown by the excellent statistical data of a large percentage of cures.

15. Pharyngeal (oropharynx and laryngopharynx) and esophageal carcinoma, especially when metastatic nodes are present, have not, in our experience, responded to any form of therapy permanently.

16. Rehabilitation with regard to development of speech following laryngectomy, plastic repair of deformities and prosthetic aids overcome many of the defects which heretofore presented difficult problems.

17. Education as to early recognition of malignant lesions and centralization of efforts in their management are two major essentials in meeting the situation, in the light of our present knowledge.

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(Discussions on this article will be incorporated in a future symposium on Cancer.—Editor)



PHYSICS OF HIGH FREQUENCY HEATING*

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The psychological constitution of man is such that he is inclined to regard as mysterious that with which he is unfamiliar. Things that cannot be explained are regarded with awe and often attributed with supernatural powers. Under the unerring analysis of the scientist the clouds of mysticism have parted, unfathomable properties become legendary, and rigorous explanations have permitted the utilization of natural phenomena. Thus by constant search for cause and effect and interrelation of functions has science progressed.

This paper will be limited to an elementary explanation of the physics of high frequency heating, a brief treatment of the so-called "skin effect" phenomena, and its relation to the problem encountered in the human body.

From the standpoint of modern physics, it is essential that we first consider a few of the high lights of recent developments in the theory of electrical conductivity. At one time it was possible to obtain a working picture of most of our natural phenomena. The greatest portion of physics when reduced to its elemental units could be pictured in simple patterns. With the tremendous strides that have of late been made in the physical sciences, it is impossible to obtain any true, simple picture. Our language has become inadequate for even meager descriptions, and physicists have been compelled to create a new language. Physics is becoming more and more mathematical; terms, phrases, relationships, functions, and symbols of the mathematicians have impregnated the language of the scientist, until now he would rather speak in the language of mathematics. And no wonder, for a verbal description that might require pages can be expressed much more precisely and completely by two or three lines of mathematics. It has become almost impossible to understand modern physics without a knowledge of higher mathematics.

In this discussion, however, the mathematical treatment will be omitted and an attempt will be made to portray a simple physical picture. This portrayal will probably not be in complete quantitative agreement with the mathematics, but it will be of sufficient scientific accuracy to give us a working knowledge of the qualitative relations of the physics of high frequency heating.

Within the last half century experimental science has reduced matter to ultimate electrical particles, the electron, unit of negative electricity, and the proton, unit of positive electricity. These two electrical particles are of the same magnitude, but of opposite charge. The electron is of the largest dimensions, but the proton is some eighteen hundred and forty times heavier. In the study of physics an attempt has been made to explain all the properties of matter on the basis of these ultimate units. The electron is one fifty-thousandth the radius of the hydrogen atom which is about one hundred-millionth of a centimeter. The atom, which is the smallest division of an element possessing its characteristic properties, is composed, according to the Rutherford-Bohr conception, of a positive nucleus supposedly built up of closely packed electrons and protons with an excess of protons. Around this nucleus and at a comparatively great distance away, revolve electrons of an exact number just sufficient so that the net charge of the atom is zero. If the charge is other than zero, the atom is in an ionized condition and is called an ion. The number of positive charges on the nucleus, which is the same as the number of electrons revolving around the nucleus is called the atomic number of the element and designates its position in the periodic system of elements. The explanation of experimental facts by the Rutherford-Bohr conception of the atom has met with such tremendous success in chemistry and physics that at least in its general

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consideration it correctly represents the true constitution of matter.

Accepting a picture of this kind it is relatively easy to account qualitatively for the electrical conductivity of metals. Metal in the solid state has its atoms packed closely, and the atoms, generally speaking, are of high atomic number. The outer electrons are, of course, not so closely bound and, due to the close proximity of the other atoms, are apt to come within the influence of other nuclei. If the influence of the surrounding nuclei is sufficiently great, they may even exist in nearly a free state, or, in other words, it is difficult to identify them as belonging to any one nucleus. Consequently they can move about quite freely. If we impress an electromotive-force on the conductor, these unrestrained electrons will take up a definite direction of migration, as is determined by the force. And if the force is maintained a current will flow.

Certain substances known as insulators pass practically no current, even under the influence of very high electro-motive-forces. It is probable that in these substances the electrons are very closely bound up to the individual nuclei.

Drude and Lorentz⁽²⁾ have treated this theory quantitatively. They consider the electrons in the metal as a gas, moving about with energy due to temperature. Thus we come to speak of free electrons as an electron gas. If an electro-motive-force is applied to the conductor containing this electron gas, the electrons will move in one direction faster and faster until they meet some obstacle which slows them down. If there were no impediment to this migration of electrons the current would increase without limit. The limit imposed on this current is a function of the structure of the metal, for the electrons must filter through the lattice work of its crystal structure. At each collision with an ion that is more tightly bound, the electron will lose energy that has been gained from the electric field. The collision with the fixed ions is observed as resistance, being proportional with the number of collisions per second. The loss of energy is manifested as heat.

Qualitatively this picture is very satisfactory, but there are very serious difficulties with the quantitative treatment. From the

classical standpoint one would expect this electron gas to behave much as any other gas, but there is a great discrepancy in the specific heat relationship, probably due to the vibration of the ions which make up the crystal. This is a very serious objection, for it indicates that not enough energy is put into the metal when the temperature is raised to account for the assumed increase in energy of the electrons.

Until recently, the theory of electrical properties of metal contained a number of conflicting hypotheses and it seemed impossible to form a theory consistent with a few simple assumptions. Within the last few years two important discoveries have changed the whole aspect of the situation. Perhaps the most important discovery is that of the *wave motion of electrons*.

Through experimental confirmation of this theory we have now substantial evidence for saying that a stream of electrons is a train of waves. It is interesting to note how the quantum theory and wave theory of light have been correlated. During the nineteenth century the weight of the evidence was with the wave theory of light. But with the discovery of the photo-electric effect, in 1888, it became necessary to use the corpuscular or quantum theory. It is most gratifying to find that electrons which we have heretofore considered purely corpuscular in nature should now come to include the properties of waves. The duality of nature, of both light and electrons, is now a fixed experimental fact. It is one of the most important discoveries that has made possible a satisfactory explanation of electrical conduction.

However, for a qualitative picture of electrical conduction we may picture these free electrons drifting through the lattice work of the metals. In the case of liquids and gases, where the distance between the molecules is greater and in which no fixed positions are maintained (as in the case of crystals), electrical conduction takes place also by the migration of ions.

Joule Effect

Joule, in 1849, discovered the relationship between mechanical force, work, and energy. The measure of work done by a force is the product of that force and the distance through which it moves in the direction of the force.

$$W = F \times D$$

In the centimeter, gram, second system the unit of work is the erg. This is a very small unit and is of no particular practical value, so a larger one is generally used. This unit is named after Joule. The Joule is equal to ten million ergs. In the English system the equivalent unit is the foot-pound. A foot-pound is equivalent to 1.356 Joules.

Joule's law is commonly formulated in electrical units: Work and energy units are, of course, interchangeable. The force in the electrical system is (E) the electro-motive-force or voltage. Instead of considering the force as acting through a distance, we consider a charge of electricity being pushed along a wire; current (I). The relation is then:

$$W = E \times I$$

Ohm's law tells us that the voltage across any portion of the circuit is equal to the resistance of the branch multiplied by the current flowing through it. Hence we may substitute for $E = IR$ giving:

$$W = I^2 R$$

which is the more familiar expression for Joules law. It is to be remembered that these equations hold true only for a current in a steady condition.

The heat is generated by the friction of the electrons and ions wedging their way through the aggregation of atoms and ions of the conductor.

Dielectric Hysteresis

Let us first consider magnetic hysteresis, for the idea of dielectric hysteresis came from the phenomenon of magnetic hysteresis with which we are more familiar. Magnetic hysteresis is more easily explained by the aid of a curve. (Fig. 1.)

We shall plot the magnetizing force along the abscissa and the degree of magnetization along the ordinate axis. In magnetizing a piece of iron it will follow the curve A, but when we demagnetize the iron it is necessary to decrease the magnetizing force considerably below the corresponding value for magnetizing, it follows curve B. If we are to completely remove the magnetism it is necessary that we even reverse the direction of the magneto-motion-force. If we again magnetize it will follow A and on demagnetizing will again follow B. The area enclosed between the two curves represents the energy

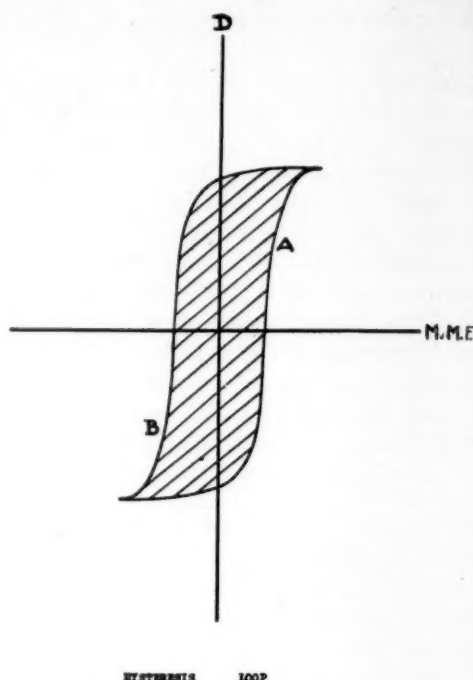


Fig. 1. Dielectric hysteresis plotted on a loop curve.

lost over the cycle and will manifest itself as heat within the iron.

In order to obtain a physical picture of the phenomenon let us consider a bar of iron as being composed of a multitude of elementary magnets arranged at random. Under the influence of a magnetic field they will tend to align themselves in the direction of magnetic force. Then if the field is reversed these elementary magnets will align themselves in the opposite direction. Since the mechanical forces present are quite strong there will be considerable resistance set up to any movement of these elementary magnets. Consequently some energy must be expended to move these elements. The work in overcoming this friction is represented as the area enclosed in the curve. The energy, as stated before, manifests itself as heat within the iron. If the bar is magnetized and demagnetized a great number of times, considerable heat may be developed. As a matter of fact, the so-called induction furnace operates on this principle.

As regards the case of dielectric hysteresis, let us consider the dielectric as being made up of electric dipoles, that is to say, small particles possessing a positive charge on one end and a negative charge on the other. If we place the dielectric in a strong electric field

these dipoles will tend to line up in much the same manner as the unit magnets did in the magnetic field. If we reverse the field, they also will reverse. It likewise takes a certain amount of energy to turn them around, and this energy goes into heating the dielectric. The individual atoms and molecules, generally speaking, are a bit more tightly bound in many of our solid dielectrics and, consequently, if the electric field is reversed often enough, considerable heat may be liberated from the friction of the dipoles changing positions. This phenomenon is known as dielectric hysteresis.

Considering it from a physical viewpoint: If we have an electric field that changes its direction a few million times a second and place in that field a dielectric, it is natural that these dipoles twisting back and forth in the body through friction with neighboring particles create sufficient heat to raise the temperature of the dielectric to a high degree.

Steinmetz, in his book, "Alternating Current Phenomena," says, that it is doubtful if true dielectric hysteresis exists. It is to be remembered that Steinmetz was used to dealing with very low frequencies as compared with those of modern high frequency equipment. He does say that a dielectric loss proportional to the 1.6th power has been observed, but that it was practically overshadowed by other losses. However, since that time experiments have been performed that have shown conclusively that large quantities of heat are generated in this manner. For example, a piece of glass suspended in a high frequency field will, after a short time become red hot, and if held long enough will melt. Pieces of bacon placed in strong fields have after a short time caught fire, due to the heat generated by dielectric hysteresis.

Skin Effect

The non-uniformity of current distribution and subsequent increase in current density at the outer surfaces of the conductor with the increased frequency is referred to as the skin-effect of a conductor. This skin-effect is a battle ground for a great deal of discussion between many physical therapists. Skin effect has been quite completely treated from the engineering standpoint and the physics is also quite comprehensive. It may be of interest to apply some of the equations to the physiological case.

Maxwell's⁽³⁾ theory predicted that due to the magnetic field set up and self-inductance at high frequencies the current in a conductor would tend to become concentrated at the outer surfaces. Lord Rayleigh⁽⁴⁾ calculated the consequent increase in resistance of a conductor to high frequency currents and his predictions were beautifully carried out and verified by Fleming.⁽⁵⁾ It is taken for granted by many workers in high frequency electro-therapy that on account of this skin effect the currents will be almost completely limited to the surface of the body, and that effects at any depth cannot be produced. Examination of Rayleigh's formula, however, shows that for the conductivities encountered in the body, skin-effect is negligible, and the path taken by the currents is the same as that for direct current. Rayleigh's formula for high frequency resistance of a cylindrical conductor is:

$$R' = R \left\{ 1 + \frac{\rho^2 l^2 \mu^2}{12 R^3} - \frac{\rho^4 l^4 \mu^4}{180 R^4} + \dots \right\}$$

R = Resistance to steady currents.

$\rho = 2\pi f = \omega$. f = frequency.

μ = magnetic permeability.

l = length of conductor.

Putting $\mu = 1$ and introducing the specific conductivity x and A the cross section. Substituting these values in the equation for R' .

$$R' = R \left\{ 1 + \frac{1}{12} \frac{(2\pi f l A)^2}{1} \dots \right\}$$

And the first correcting term is $\frac{1}{3}(\pi f A)^2 X^2$

Conductivities encountered in the body are in the order of $10^2 \omega^{-1}$ or in e.m.u. = 10^{-11} . Taking $f = 3 \times 10^7$ (10 meters) and $A = X \pi r^2$ we obtain for the first correction term $\frac{1}{3}(\pi A f X)^2 = 5 \times 10^{-5}$.

Each successive term in the series is progressively smaller and smaller, so that we are justified in assuming that the resistance is nearly that of the steady current condition and for all practical purposes the skin-effect is negligible.

Relation Between Frequency, Conductivity, and Dielectric Constant

D'Arsonval⁽⁶⁾ has shown that the heating of a tissue by high frequency current is not indicated truly by a thermal ammeter in the

circuit. He explains this discrepancy by part of the heat being generated by the Joule effect and the rest by dielectric hysteresis. Fabry⁽⁷⁾ has attempted to show analytically how this discrepancy comes about. It was discovered experimentally by d'Arsonval that in saline solutions existed a certain specific resistance that gave maximum heating effect. This resistance appeared to be some function of the frequency. Richards and Loomis⁽⁸⁾ have shown that for practically all monatomic ions this relation is true.

Fabry has developed an equation relating the quantities: Specific resistance, heat generated, frequency, and dielectric constant. He says that the current through the ammeter can be broken up into two components, a power component and a wattless component. The two components are in quadrature of phase and hence must be combined vectorially. The power component is that given by the usual Ohm's law.

$$I_p = \frac{E}{R}$$

Where I is expressed in amperes, E in volts, and R in ohms.

The wattless component is given by:

$$I_2 = \omega CE \quad \omega = 2\pi f \quad C = \text{capacity in farads} \quad E = \text{volts}$$

Combining vectorially according to the root of the sum of the squares.

$$I_{\text{total}} = \sqrt{I_p^2 + I_2^2}$$

Taking the real part of this current, squaring it, then multiplying it by the resistance his expression for power is obtained as:

$$P = \frac{I^2}{a} \left\{ 1 + \frac{\rho}{16\pi^2 v^2} \right\} K^2 \rho^2$$

ρ and K being the specific resistivity and dielectric constant, respectively. Solving for a value of ρ for maximum heating (power) the value below is obtained:

$$\rho = \frac{4\pi V^2}{\omega K}$$

This equation for power of Fabry holds within certain limits for the experimental results obtained by d'Arsonval. But as Fabry says, it falls down in the limits of frequency of zero and infinity. Richards and Loomis

have also developed an equation of the same type, but it also does not hold for the limits of zero and infinity.

McLennan and Burton⁽⁹⁾ have treated the problem of heating of electrolytes in a high frequency field both experimentally and analytically. Their results are in very close agreement theoretically and practically, and they have handled the problem in a competent manner. For any high frequency work their results are well within the limits of experimental error. It should be pointed out that one must be very careful in selecting a value of specific resistance to use in this formula, for it is not the direct current value but a function of the frequency as well. Richards and Loomis give the formula developed by Pierce: It is also mentioned by McLennan and Burton.

$$\text{Power} = \frac{4E^2 C \omega \rho K}{K^2 \left\{ 1 + \frac{2C}{C_0} \right\} + \frac{4\pi \rho^2 4C^2}{C_0}}$$

ρ = specific conductivity.

C_0 = capacity of containing cell.

K = dielectric constant.

While this formula is quite exact for high frequencies it does not hold for the limits zero and infinity.

A more rigorous attack would be to consider our body as being made up of an infinite number of infinitesimal condensers in series with a resistance —R— and this combination shunted by a leakage resistance —r—. We can then set up our circuit relationship with the combination and integrate throughout the body.

Let us consider an incremental volume δv . If the intensity of the field is such that a potential E is impressed across this volume a current of the value $E \div r$ will flow in the leakage resistance, and in the condenser branch $E \div Z$ where Z is the impedance offered to the current.

The equation of voltage across this branch is:

$$E = iR + \frac{1}{C} \int i \delta t$$

If E is a simple sinusoidal function of time this equation can be differentiated and solved as a simple linear differential equation. The solution will involve two parts: a complementary solution (transient state), and a particu-

lar solution (steady state). The particular solution is of interest to us and can be expressed very simply:

$$i = \frac{E \sin \omega t}{\sqrt{R^2 + \frac{1}{\omega^2 C^2}}}$$

The power dissipated in the leakage resistance will be $P = EI$.

Since $E = \frac{I}{r}$ we may substitute for I , obtaining the expression for the power dissipated by the leakage resistance. (P_1).

$$P_1 = \frac{E^2}{r}$$

And the power in the condenser branch will be $P_2 = EI \cos \theta$ where $\cos \theta$ is the power factor and is equal to

$$\frac{R}{\sqrt{R^2 + \frac{1}{\omega^2 C^2}}}$$

Substituting the value for I in the condenser branch and this value for $\cos \theta$ we obtain for P_2 :

$$P_2 = \frac{E}{\sqrt{R^2 + \frac{1}{\omega^2 C^2}}} \times \frac{R}{\sqrt{R^2 + \frac{1}{\omega^2 C^2}}} \times E \times \delta v$$

The total power will be the sum of $P_1 + P_2$.

$$P_{\text{total}} = E^2 \left\{ \frac{1}{r} + \frac{\omega^2 C^2 R}{R^2 \omega^2 C^2 + 1} \right\} \times \int \int \int \delta y \delta x \delta z$$

This equation, it is easily seen, holds for both limits for when we introduce zero frequency it reduces to:

$$P_{\text{total}} = \frac{E^2}{r}$$

And for an infinite frequency:

$$P_{\text{total}} = E^2 \left\{ \left(\frac{1}{r} \right) + \left(\frac{1}{R} \right) \right\}$$

which is exactly what we would expect for an infinite frequency, for a condenser will have zero impedance and the equivalent circuit would be the two resistances in parallel.

It has been mentioned before that there is a particular value of conductivity for which maximum heating occurs. If we differentiate the equation for total power with re-

spect to the resistance we can solve for this value of conductivity.

$$\frac{dP}{dR} = E^2 \left\{ -2\omega^4 C^4 R^2 (R^2 \omega^2 C^2 + 1)^{-2} + (R^2 \omega^2 C^2 + 1)^{-1} \omega^2 C^2 \right\}$$

Setting $\frac{dP}{dR} = 0$ and solving for the value of R which gives maximum dissipation of power:

$$R = \frac{1}{\omega C}$$

Now if our increment of volume is a unit cube we may substitute for the value of C ,

$$C = \frac{KA}{4\pi} \quad \text{and}$$

since $\omega = 2\pi f$ and $f = \frac{c}{L}$, c = speed of light, L = wave length.

$$\text{Hence } R = \frac{2L}{cK}$$

This agrees with the results of Fabry, McLennan, Burton and others. It is a very important relationship, for it tells us the wave length that will produce maximum heating within a body of certain dielectric constant and specific resistance.

McLennan and Burton have applied this relationship to certain biological cases and have also checked it experimentally. Bagarsky⁽¹⁰⁾ and Tangl give for the conductivity of the blood serum 110×10^{-4} mhos. Furth⁽¹¹⁾ has determined the dielectric constant of blood to be 85.5. We can apply our equation and calculate the wave lengths that would favor the heating of the electrolyte of the plasma or of the protein, respectively. For the electrolyte it is about 1.3 meters, and the protein is about 14 meters. The wave length that would heat both alike is the geometrical mean of 4.3 meters. We would expect that wave lengths under this value would favor the plasma, and that wave lengths over this quantity would favor the protein.

A series of tests have been run on horse blood and the selective effect has been very markedly observed. For a specific wave length most of the heat originated in the proteins, less in the corpuscles, and least in the electrolyte fluid of the plasma. It was interesting to note that as the frequency was increased the relative heating in the corpuscles increased while that of the proteins decreased.

This selective action will undoubtedly open many new channels for physical therapy, but it is unlikely that any great strides will be made until vacuum tube oscillators are put into universal use, for it is impossible with a spark excited oscillator to obtain any sharp definition of frequency.

Conclusion

Electric heating is caused by internal friction of ions, electrons, and the structural atoms of the body. Joule's law holds true for fluctuating currents only if we define our resistance in terms of the heat generated. For most dielectrics the biggest portion of the heat generated is by dielectric hysteresis and inter-atomic friction.

According to Rayleigh's formula skin effect in the human body is of little or no consequence.

For a given wave length there exists a certain value of resistivity for which maximum heating occurs. It must be remembered, however, that this is mathematically true only if the dielectric constant remains constant. However, the variation in the dielectric constant with wave length is usually of negligible value.

Let me again mention the possibilities of localizing heat by the use of specific wave lengths. For example, suppose that it were desirable to treat a bladder. It could be filled with an electrolyte of known specific resistance and dielectric constant which differed materially from any of the surrounding tissues or serums. The patient could then be

put into a high frequency field of specific wave length, a test sample could also be placed in the same field, and by checking the temperature of the sample a constant indication of the temperature of the bladder could be maintained. There are undoubtedly a multitude of applications for this selective action once it is given a little thought.

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EDITORIALS

IONIZATION IN RHINOLOGIC PRACTICE

Ionization of the nasal passages is by no means a new therapeutic method. It has been employed in the intumescent types of rhinitis and in certain forms of sinusitis for more than twelve years with marked success. The simplicity of technic, such as was advocated by Hollender and Cottle,⁽¹⁾ has resulted in its comparatively wide adoption.

It was quite natural, therefore, that recent reports of successes with ionization in hay fever aroused widespread interest in and enthusiasm for this method, since hay fever is one of the most recalcitrant conditions with which rhinologists have had to cope. Some justification for the general interest lies in the fact that it was early appreciated that ionization possesses promising therapeutic possibilities unattainable by other methods.

One of the early publications on the treatment of hay fever by intranasal zinc ionization appeared in Great Britain from the pen of Franklin.⁽²⁾ It attracted attention to the new application of a comparatively old method for the relief of allergic nasal conditions. Lately the literature has been enriched by a number of observers, whose experiences with

ionization in seasonal hay fever merit serious consideration. Warwick,⁽³⁾ for example, claims that in a series of 40 patients, 32 were afforded complete relief by only one ionization, seven required two such applications, while only one had to be given three seances before permanent relief was obtained.

This series is particularly striking because in a number of the patients positive reactions other than those of autumnal pollens were established by sensitization tests. In a few cases even sensitivity to certain foodstuffs was overcome, since after ionization, contact with the concerned foods no longer produced nasal symptoms. Furthermore, while eight of the patients had received no previous treatment, the remaining 32 had been given all kinds of desensitizing vaccines, topical applications and surgical procedures without any symptomatic relief.

Alden⁽⁴⁾ analyzed 19 cases of typical autumnal hay fever he ionized during the 1933 season. His series included a child 10 years of age and adults whose ages varied between 22 and 58 years. Alden, too, presents in his series some patients who had not been benefited by previous systemic and topical treatments. This author obtained immediate symptomatic relief of all patients during the entire

season, with 50 per cent remaining free during the following season. In 50 per cent of the remainder he succeeded in affording prevention against attacks by ionization employed just before the beginning of the pollen season.

Elsewhere in this issue Hollender⁽⁵⁾ reports greater beneficial effects from ionization in the perennial type as compared with those obtained in the seasonal form of hay fever. Considering that Franklin⁽²⁾ reports an opposite observation, one must assume that probably the variance of observations of Hollender and Franklin can be explained by a difference in their technics. It must be borne in mind that of late workers have made use not only of specially constructed apparatus but of electrolytes other than zinc or copper. Those who have practiced simple zinc ionization for about a decade, have obtained good results from any source yielding a smooth galvanic current, provided one could measure the intensity of the current with a reliable milliamperemeter. Either zinc or copper has proven a satisfactory electrolyte. Later workers, however, have not remained content with such a simple outfit, but have made use of complicated apparatus and of electrolytes composed of cadmium, tin, and zinc. It is more than doubtful that these "compounds" have a better therapeutic effect than the simple electrolytes, and it is equally a matter of doubt whether expensive galvanic "machines" are more suitable for ionization than simple generators activated by a lighting main or a battery of cells.

It is undeniable that ionization is as yet empiric therapy. Its rationale has yet to be established. Efforts in that direction are not wanting, so that in time a scientific foundation for the clinical use of intranasal ionization may be secured. McMahon⁽⁶⁾ has undertaken a series of interesting experiments which establish beyond doubt that ionization produces destructive changes in the mucosa of the frontal sinuses in dogs. It is clear from this experiment that in clinical applications metallic ionization must be measured in intensity corresponding to the desired therapeutic effect.

There still are a number of problems to be solved, moot questions to be answered. Intensive laboratory and clinical research is needed to bring more light in the vexing problems of

the therapy of allergic nasal diseases and especially of hay fever.

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FLUORESCENT ULTRAVIOLET IN DIAGNOSIS

Present interest in ultraviolet fluorescence is the result of authoritative information that characteristic and definite changes of diagnostic value can be demonstrated in serologic and pathologic material. This phenomenon has long been recognized as a form of photoluminescence excited by light and emitted by certain elements such as fluorspar. Fluorescence results from absorption of energy of one wavelength and its emission at a greater one. Certain organic and inorganic substances apparently have the ability to absorb energy of radiation at one length and emit it at a greater wavelength, creating a luminescent effect independent of visible light. For this study use has been made of hot and so-called cold mercury vapor lamps.

That fluorescent effects are not limited to abnormal material has been shown by Reche,⁽¹⁾ in normal and abnormal sera, and by Danckwortt⁽²⁾ in normal tissues. For the normal sera use was made of four typical blood groups. With incident ultraviolet rays and through a layer of 7 mm. thick, the serum of group number 0 took on a grey-olive matt color; blood group A showed grey-green color; group B, grey-olive, and group A.B. grey-brownish matt. With transmitted ultraviolet through sera of 1 mm. thickness the same groups showed similar changes with increasing intensity. Reche states that "the sera

of the clinic patients (102 in number) showed in striking contrast to those from healthy persons, first, a surprising variety of colors, and secondly, great differences in the strength of fluorescence." Violet and red colors were entirely absent, while yellow, especially yellow-green, blue-green, blue-grey, and blue predominated.

Spectroscopic investigation of the sera was also informative and disclosed some interesting facts. In the normal sera the violet wavelength 4050 shifted into the blue or blue-green, while line 4360 remained unchanged. In diseased sera many spectral lines either were missing or were shifted from their normal position. The fact that the investigation covered a wide range of affections—inflammatory, infectious, toxic and malignant—which provoked fluorescent color differentiations in the sera, prompted this author to hint at "fluorescent diagnosis" as an important adjunct in the recognition of disease as well as for tissue diagnosis. He even postulates that it is probable that fluorescent appearance in disease occurs gradually during its course, varying in intensity according to its severity, and that its detection in the incipient states will be that needed aid in diagnosis unobtainable at present by any of the known methods. As regards its diagnostic value in cancer, Reche calls attention that "the circumstances that carcinoma cases among our material showed without exception marked colors, strong luminosity, and a very characteristic division of the spectrum lines indicates that such speculations are not too rash."

That this assumption is not virginal but rather the corollary to authentic reports is indicated by the existing literature on the subject. Filtered ultraviolet radiation has been utilized for study of normal tissue by Danckwortt, a contribution of material aid in the diagnosis of pathologic and malignant tissues. By the aid of ultraviolet fluorescence one can now differentiate at a glance osseous and cartilagenous structures of varying age. The difference is not of shadings of one color but rather of colors of a contrasting hue. For example, cartilage in the young is uniform light-blue as compared to the whitish-yellow in adult types. Softer tissues can also be differentiated with equal facility.

Sutro and Burman⁽³⁾ have studied over 500 specimens from operative and post-mortem material, correlating the gross microscopic

findings with fluorescent ultraviolet light. Their interest was to secure, if possible, a speedier differentiation of gross tissues. Summarizing their studies they point out the characteristic color changes under filtered ultraviolet rays. This is of particular interest because of their detailed description of a specimen of carcinoma of the breast:

The tumor is uniformly white (under normal light), and is surrounded by contiguous fatty tissues. Under filtered ultraviolet radiation, the area of the tumor . . . is definitely divided into two portions. The upper is hazy blue, and the lower, white. Below this white region there is a zone containing numerous blue areas. Microscopically, the upper portion is medullary adenocarcinoma, while the lower portion is quite scirrhous. The smaller blue areas are foci of carcinoma metastases. Gross infiltration of the skin by carcinoma is also observed . . . In another breast, a small tumor nodule in the fat, which is natural light looked much like ordinary fat, was distinctly outlined as a bluish-purple nodule under the radiation.

These authors have done much to stimulate adoption of ultraviolet fluorescence as an aid to surgeons and pathologists for selective differentiation of even the smallest tumors. In a paper published elsewhere in this issue, Blech⁽⁴⁾ points out the clinical value of this simple but highly useful addition to the operating room equipment. In cases where biopsy is delayed or inadvisable, or where for some reason an immediate pathologic report is not obtainable, he advocates the routine employment of "filtered ultraviolet on the extirpated growths in order to obtain a tentative warning what to expect." This important addition to the surgeons equipment offers greater insurance against the partial excision of a malignant mass. Ultraviolet fluorescence has been proclaimed as a new dimension in light radiation and as a diagnostic means of great potentiality, an opinion justified by the clinical and laboratory evidence at hand.

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DEPRESSION

During the years just passed the word "depression" has been common in our vocabulary. We are prone to connect the meaning of the word in relationship to financial and economic problems and conditions; while this is true, there are other situations in life which warrant its use.

We realize today more than ever before the tremendous influence of the mind over the body. This mysterious connection is baffling and inexplicable, and yet there is nothing more real than the mental influences over physiological functions. Every metabolic process may be disturbed by psychic influences. The teaching in medical schools a half century ago dealt sparsely, if at all, with these profound mental emotions which make for disordered bodily conditions. Every manifestation of disease was thought to be due to abnormality of tissues and organs, palpably deranged. The syndrome was considered as evidence of a definite disease, an entity, a reality. No thought was given to the possibility of psychic reactions which might have been the major cause of the ailment.

Socrates said two thousand years ago: "There is no cure for the body apart from the soul; and the reason why so many diseases elude the physicians of Greece is that they know nothing of the soul." The wisdom of this prince of Grecian sages is now being partly appreciated. Psychiatry is a science in process of development; but still we "see through a glass darkly." While there are yet the obscuring fogs which encompass our judgment, perhaps the mists will gradually clear so that our diagnostic vision may become more certain and acute. The "soul" must be considered in the treatment of disease.

The tragic death of Curran Pope comes as a depressing shock to his many friends and colleagues who knew and loved him. A gentleman of the old school, a skilled physician, he possessed an attractive personality that radiated with good humor, friendliness and comradeship. He was a citizen of whom not only Louisville but the whole country might have been proud. He did much for the advancement of Physical Therapy, and was always a champion of the scientific application of the approved methods in physical medicine. Upon his normally clear and active brain there somehow descended the overpowering influences of a disastrous depression — mysterious, unbe-

lievable, deadening. Who could have harbored for an instant the thought that Curran Pope's life would have ended by his own hand? If only his friends and colleagues might have known! Perhaps a kindly, understanding word, a touch of the hand, a smile of love and friendship might have averted the tragedy. Presumably, no one diagnosed his mental depression or read aright the signs of psychic aberration which distorted his thinking, befogged his active reasoning brain, and led to his destruction. If a kindly arm could have been placed around his shoulders, it might have served to clear his depression and may have been instrumental in rolling the temporary mists from his suffering soul.

A message comes to all of us as disciples of the healing art. We are ideal physicians indeed if we can have vision, deep and sympathetic, beyond the body and deeper than its organs and tissues, into the mind, soul and emotions of our patients. "A kindly word doeth good like a medicine" was spoken by a prophet of long ago, and spoken more truly than we realize. "There is no cure for the body apart from the soul."

LOSS OF HEAT FROM EXTREMITIES

The arms and legs of man are customarily thought of primarily in connection with their functions of prehension and locomotion. However, the character shape of these appendages and the fact that they extend out into the surrounding atmosphere render them of particular importance in connection with those physiologic activities related to skin surface. It has been calculated that approximately two-thirds of the entire surface of the body is accounted for by the area of the arms, hands, legs and feet. As about 75 per cent of the heat loss from the body takes place through conduction, radiation and convection from the skin surface, it might reasonably be expected that the extremities would assume an important role in both the conservation and loss of heat. A recent study by Maddock and Collier (*Am. J. Physiol.*, 106:589 (Nov.) 1933) has yielded quantitative data bearing on this point. The movement of blood toward or away from the body surface in various localities was measured in human subjects by determining the skin temperature. Heat is produced by metabolic chemical reactions in the body and brought to the surface by the blood, where it is dissipated. It was observed that an increase in the surrounding temperature was accompanied by an augmented skin temperature; the extent of the change was least on the skin of the forehead and trunk and greatest in the extremities. The dissipation of heat was more marked in the legs than in the arms and increased distally. The

influence of the basal metabolic rate on heat loss was similarly examined in both normal and abnormal individuals. Here again an increased heat production was accompanied by a higher level of heat loss and the topographic distribution again emphasized the significance of the extremities in this respect. The toes seem especially responsive to the necessity of the body to lose heat; there was demonstrated a linear relationship between the basal metabolic rate and the dissipation of heat from the skin of the great toe. It appears that the exigencies of temperature control require movements of blood of considerable magnitude to and from the periphery. This circumstance accounts in part for the changes in volume of the extremities—the swelling in summer and the shrinkage in winter. As body heat must be conserved in winter, and heat is lost with particular readiness from the arms and legs, one may well view with some apprehension the current habits of dress which encourage the omission of stockings from the costume, especially among little children, whose temperature equilibrium is none too secure at best. — (Current Comment, J. A. M. A., 102:1304 (April 21) 1934.

THE PRODUCTION OF ARTIFICIAL PYREXIA

We have recently considered in these columns (May 19, p. 1075 and May 26, p. 1129) the thermostatic control of the warm-blooded animal and some of the outcomes of the attempt to evade this control and to produce artificial fever, local or general. It is important to be aware of the nature of the agencies employed. Until recently the term "diathermy" was limited to the production of heat in the human body by the passage of oscillating currents with a frequency of about 1,000,000 a second. These were generated by the discharge of a condenser through a coil of suitable inductance, or in some of the newer machines by causing a thermionic valve to generate oscillations. The mechanism in the latter case is more difficult to understand than in the simple spark machine, but it is analogous in some degree to the action of the balance wheel or pendulum of a clock. In the simplest arrangement, two circuits each containing an inductance and capacity are connected to the appropriate electrodes of the valve, and are at the same time so situated that they are inductively linked with one another. In this state any slight variation in one circuit will produce an enhanced variation in the other, owing to the amplifying properties of the

valve. This induces a second impulse back into the first circuit, and under suitable conditions the valve will break into a sustained oscillation which continues as long as power is supplied to the circuit. The frequency of the oscillations produced depends entirely on the electrical constants of the circuits employed, but the intensity of the high frequency circuit is a function of the size of the valve and its capacity for taking reasonable power without overheating. In recent years there has been considerable investigation of the action of currents of still higher frequency, of the order of 10 million a second. Such currents have been obtained from valve outfits almost exclusively, though one type of spark instrument suitable for local treatment has been made in this country. When such high frequency is in use, the patient is placed between two insulated plate electrodes which are not in contact with the skin, the tissues of the body forming part of the dielectric of a condenser. Smaller plates are used when local treatment is intended.

In another form of instrument recently devised, the Inductotherm, the currents are produced in a flexible insulated cable which is wound round the body or part to be treated. Such an arrangement would lead to a different distribution of the induced currents, but there is no essential difference between the two methods. In both cases the observed rise in temperature can be regarded as the result of induced currents of high frequency in the body. Merriman, Holmquest and Osborne (Am. J. M. Sc., May, 1934) maintain that there is a difference in conductivity of various tissues towards these new currents as compared with diathermy, but it would be premature to deduce this from the results of the experiments in which the methods differ so widely in detail. There is some difficulty in finding a suitable term for the description of the new therapeutic agent. In America the word "radiotherapy" has been suggested as being the production of heat by currents such as are used in wireless telegraphy. But the term might lead to confusion with radiant heat. There is a tendency to lay emphasis on the presence of electromagnetic radiation as being the heating agent, which does not seem to be justified by consideration of the machinery used. The fact that the frequencies in question are the same as those used in so-called short-wave wireless has suggested the term "shortwave diathermy." While this may not satisfy everyone, the term is convenient and it emphasizes the relationship of the new agent to the original diathermy current. — [Lancet 226:1348 (June 23) 1934.]

SCIENCE, NEWS, COMMENTS

October Meeting of the Pacific Physical Therapy Association

The first regular meeting (1934-1935) of the Pacific Physical Therapy Association was held at the lecture rooms of the Hollywood Hospital, at 8 P. M. on October 10. Two papers were read. The first was a report of the 13th Annual Session of the American Congress, at Philadelphia, on September 10-14, by Drs. Worster, Hubbard, and Symonds. The second paper was a timely and informative address by Dr. David H. Kling, Director of the Arthritic Clinic, Cedars of Lebanon Hospital, Los Angeles. The topic was, "Physics and Clinical Characteristics of Short and Ultra-Short Radio Waves" (Radiathermy), and was discussed by C. J. Breitwieser, and Robert C. Burt.

Dr. Titus Moves New York Office

We wish to announce that Dr. Norman E. Titus, a member of the Congress, has changed his office address from 57 West 57th Street to 730 Fifth Avenue, New York City.

Fifth Annual Medico-Military Symposium The Mayo Clinic

The 1934 Medico-Military Symposium for Medical Department Reserve Officers of the Army and Navy will be held at the Mayo Clinic, from October 7th to 20th, both dates inclusive.

This is the Fifth Annual Inactive Duty Training Course to be held at the Mayo Clinic and will follow the plan which has proven so satisfactory in past years; that is to say, the morning hours will be devoted to attending clinics on subjects selected by the student officers, and the afternoon and evening hours subjects given over to work in Medico-Military subjects. The Medico-Military Program will be under the personal supervision of Colonel Kent Nelson, M.C., U. S. Army, Corps Area Surgeon, Seventh Corps Area, and Captain J. B. Mears, M. C., U. S. Navy, District Medical Officer, Ninth Naval District.

The staff and faculty of the Mayo Clinic have placed their unexcelled facilities at the service of their government in the interest of preparedness and have extended an invitation to all the service to participate. The two weeks' excellent clinical post-graduate work must make a definite appeal to all who are interested in their profession and does not incur as great a loss of time for the private practitioner that normally pertains to post-graduate work along professional lines.

The general motif of the Medico-Military part of the Symposium will be "Public Health and Its Relation to National Defense." The problem of

administration in military service presents features not dealt with in private practice. In the great field of sanitation as applied to military service, the medical officer has a distinct specialty. This course offers valuable and interesting training for the medical officer in all the components of our national defense. A splendid program of a thoroughly practical nature has been carefully compiled and the speakers selected for their ability to present authoritatively the subject assigned to him.

Application for this course of Inactive Duty Training should be made either to the Corps Area Surgeon, Seventh Corps Area, Omaha, Nebraska, or to the District Medical Officer, Ninth Naval District, Great Lakes, Illinois. Applications should state the character of the work the candidate desires to follow in the morning hours. All student officers are expected to attend and participate in the afternoon and evening sessions. Each applicant should fully understand that the invitation to accept this course of study without charge is extended by the Mayo Clinic; that the project is without expense to the government; and that one hundred hours' credit will be given those who take and complete the course. While it is desirable to attend the entire course, those whose time will not permit this may join or leave at any time and will receive credit for the hours spent in training. Uniforms are optional.

Dr. Edgar Mayer Opens New York Office

Dr. Edgar Mayer has opened new offices at 470 Park Ave., New York City. His many friends wish him the success and happiness due to one who has spent the better part of life in contributions toward scientific medicine.

Progress of Short Wave Therapy — A Report from the Colleges of Vienna

As evidence of the increasing interest in radiathermy, the following letter from Vienna, published in the *Medical Record* of June 20, 1934, is presented. Of significance is the growing tendency to restrict ultrashort waves to the acute and purulent affections and the short waves to the chronic varieties.

The work of L. H. Stieboeck, who is one of the foremost authors in the field of short wave therapy and who ten years ago had recognized the importance of it in medicine and published his opinion of this therapy, deals with the technic and clinical use of the short waves.

As specially favorable indications for short wave treatment Stieboeck names osteomyelitis, endarteritis obliterans, granuloma of the root of

the tooth, severe otitis externa, neuritis acuta, trigeminus neuralgia, and acute tonsillitis.

Erwin Last reports on his clinical experience with short waves. After a comparison of the different applications of high frequency currents in the form of diathermy, the author speaks about the theoretical and experimental bases of short wave therapy, especially about the question of dependability of the length of the waves and the raising of temperature. The question whether the therapeutic effect of the short waves is a sequence of the so-called specific electrical effect of the same, or of the rising temperature of the tissue which occurs at the same time, or whether it can be attributed to both of these factors, cannot yet be decided. To the indication field of waves of more than fifteen meters belong, according to the author, the chronic diseases of the muscular system, i. e., the deforming arthritis, bursitis, acute and chronic myalgia, neuritis, some form of vasomotor disturbances and adnexitis.

Cancerous Diseases Treated by Continuous Irradiation

Cancerous diseases are now being fought with continuous low-voltage doses of x-rays over the entire body as well as with 700,000 volt dosages for short periods. The comparatively new method of continuous irradiation was reported by Drs. Lloyd F. Craver and William S. MacComb of Memorial Hospital, New York City, and abstracted in *Science News*.

Patients being treated by this new method, called Heublein method because it was first put into operation at Memorial Hospital by the late Arthur C. Heublein, lie in one of four beds in a specially constructed ward. For as long as 20 hours out of every 24, x-rays are sent into their bodies from a low-voltage machine near the ceiling of the room. This is continued for a period varying from several days to three weeks.

"Experience with this method in 134 cases over a period of two years indicates that it is a valuable addition to the treatment of several radio-sensitive tumor processes, such as the leukemias, lymphosarcoma, Hodgkin's disease and multiple myeloma," reported Dr. Craver, who has been in active supervision of the work from the beginning.

"The results of the treatment in chronic lymphatic leukemia and pseudoleukemia are, in our experience, superior to those obtained by local irradiation. It appears to be of only slight value in the treatment of radio-resistant tumors," he concluded.

X-Rays Determine Lung Ventilating Efficiency

A method of using x-rays to find just how efficiently a person's lungs are being ventilated was described by Dr. Walter W. Fray of Strong Memorial Hospital, Rochester, N. Y., at the

American Congress of Radiology and reported in *Science News*.

Apparently some patients suffering with tuberculosis and other lung diseases have more difficulty with breathing than would be expected from the amount of lung tissues that is seen in x-ray pictures to be affected, while in other cases the patients are able to breathe with little or no difficulty, in spite of a large diseased area. Lack of a standard of the ventilating efficiency of normal lungs has handicapped physicians in determining the extent of disability along these lines.

Dr. Strong and associates worked out a method of determining the normal pulmonary ventilation and then used the method in over 100 cases of various kinds of lung diseases. It proved to be useful in the following ways: in following the progress of chronic forms of pulmonary disease such as pulmonary emphysema, asthma, chronic bronchitis and bronchiectasis; in assaying the degree of disability in industrial disease such as silicosis for purposes of compensation; in identifying suitable cases of tuberculosis for treatment by collapsing part of the lungs; in determining the presence of extent of disturbed ventilation in cases of a certain kind of heart trouble; and, finally, in establishing both the diagnosis and progress of chronic pulmonary disease.

Blue Skin Reaction May Help Solve X-Ray Mystery

Science News calls attention to a new reaction to x-rays, discovered by Dr. J. C. Mottram, Director of the Research Laboratory at the Mount Vernon Cancer Hospital, London, may help to solve the long-standing mystery of what happens in living tissues after they have been x-rayed but before any recognizable changes occur. Dr. Mottram's research is described in *Nature*.

"If, during the afternoon the skin of a rat be exposed through a small hole in a lead screen to approximately a U. S. D. of x-rays, and immediately afterwards a solution of pyrrol blue be inoculated into the circulation, then the next morning there will be seen," he says, "a blue mark on the skin precisely corresponding to the hole in the lead screen."

He thinks this indicates that the x-rayed capillary blood vessels have been altered so that the dye passes through them more readily than through normal capillaries.

The special importance of this observation lies in the fact that the reaction occurs within 24 hours after the application of the x-rays. Only three other instances of biological change within comparatively few hours after exposure to x-rays have as yet been known, and none of them are easy to determine.

"It is to be hoped," concludes Dr. Mottram, "that this new reaction with pyrrol blue, when fully exploited, will elucidate some of the hidden changes which occur during the latent period."

Heated Seeds Produce Freaks

Evolution by jumps, or mutation, can be brought about not only by the action of radium and x-rays upon seeds and eggs, but also by the prolonged exposure of seeds to high temperature.

According to *Science News* Prof. M. Navashin, together with P. Shkvarnikov of the Timiriazev Biological Institute in Moscow, describe in *Nature* how seeds were enclosed in a closed bottle, kept for twenty days or more at a temperature of 131 degrees Fahrenheit and afterwards allowed to germinate.

Most of the seedlings produced were abnormal, the development of both roots and leaves being affected, and many did not survive. A considerable number of the surviving young plants displayed various abnormalities of leaf shape. A microscopic examination of the root tips showed that the chromosomes — minute rod-like bodies believed to be responsible for the inheritance of characters in both plants and animals — had been badly disarranged from their normal positions.

Race Crossing Inevitable Where Races Are Neighbors

Nazis in Germany, the late unlamented Klan in this country, nativists and pure-race enthusiasts everywhere, have naught but their pains for their labors in any land where two or more different races lived side by side. The races will inevitably mingle blood.

"Among the few statements that the scientist who studies human beings may make without fear of serious contradiction is that human groups do not meet but that they mingle their blood-streams," said Prof. Melville J. Herskovits of Northwestern University, in an address given in Chicago recently under the auspices of Science Service.

Not even the almost universal tendency of peoples to persecute and penalize the racial hybrid serves to prevent race crossing, Prof. Herskovits declared. In our own West the "squaw man" was an object of contempt, and his sons looked down upon as "half-breeds"; in India, where not merely to mate with but even to touch an outcaste mer-

its eternal damnation, intercaste children are born none the less.

These offspring of race crossing offer the student of human heredity his most interesting, perhaps his best, opportunity to study the Mendelian mode of inheritance, insofar as it affects human beings; for obviously not even the most enthusiastic eugenists can pen up young men and women like guinea pigs.

One of the really well assured results of such studies, Prof. Herskovits stated, is the establishment of the wholly fictional character of the "throw-back" tar-colored baby, born to parents with slight traces of Negro blood in their veins. We can depend upon children of mixed ancestry to "average" between their parents in skin, color, hair character and other racial marks. If a black baby is born to such parents, something besides remote ancestry is amiss. — *Science News Letter*, March 31, 1934.

Radio Waves Cook Egg From the Inside Out

Prof. Jellinek, French scientist, placed a raw egg between two condenser plates connected to a short wave radio transmitter. The power applied was 1,000 watts, the wavelength three meters. After five minutes exposure, the yolk of the egg was found to be cooked hard and solid, but the white was scarcely affected, being only of the consistency of a jelly. Thus the egg was cooked from the inside out. Yet the temperature of the yolk at the end of the cooking was only 140 degrees F., while that of the white was 176.

This experiment was not performed as a stunt, but as part of a serious and extensive research on the effect of short radio waves on different organic tissues, which Prof. Jellinek recently reported to the Paris Academy of Sciences.

The eye of an ox was similarly experimented upon, and it was found that while the crystalline lens was little affected, other parts of the eye were greatly affected.

It is important to study this selective action of the waves, and their different heating effects on different tissues, Prof. Jellinek said, because of the recent use of short waves for therapeutic purposes. — *Science News Letter*, September 1, 1934.



THE STUDENT'S LIBRARY

PHYSICAL TREATMENT BY MOVEMENT, MANIPULATION AND MASSAGE. By *James B. Mennell*, M.A., M.D., B.C. (Cantab.), etc. Medical Officer, Physiotherapeutic Department, St. Thomas' Hospital. Third Edition. Cloth. Price, \$6.00. Pp. 601 with 274 illustrations including 32 plates, 8 in color. Philadelphia: P. Blakiston's Son & Co., Inc., 1934.

The medical profession has awaited the present edition with considerable interest, realizing that its past perfection could only gain greater prestige at the hands of one who has come to be regarded as one of the outstanding authorities on the subject. In its present format we note that considerable revision and rewriting have been introduced into the text and new chapters incorporated, such as "Joint Manipulation," "Referred Pain from the Back," and "The Use and Abuse of the Faradic Current." Thus the work has been brought down to date and at the same time has raised its stature to the most authoritative and comprehensive contribution in the English language. In the space of 600 well illustrated pages and 37 chapters the author discusses in detail the general and special principles of massage, manipulation and movement, introducing into this exposition a wealth of practical information of benefit to students and medical practitioners. It is presented in that understanding and simple style which comes from concise expression and simple diction. That it is exhaustive in its scope is indicated by the amount of data evaluated and the variety of affections considered. The technic is based upon logical premises and upon a rich experience, this being supported by data gleaned from physiologic evidence. It covers the various and accepted methods in massage, mobilization (active and forced movement) as a sequel to massage, remedial, re-educational exercises, purposive gymnastics for soft and fibrous tissues, the treatment of fractures and sprains, bruises, and other concomitant affections so frequently encountered in daily practice. As in the past, so more now, this work will be regarded as the *vade mecum* in this field of medicine. It is a sensible, conservative, and altogether well balanced exposition on this important but much abused topic of practice and deserves highest praise.

OBSTETRIC MEDICINE. The Diagnosis and Management of the Commoner Diseases in Relation to Pregnancy. Edited by *Fred L. Adair*, M.A., M.D., F.A.C.S.; *Mary Campau Reyerson* Professor of Obstetrics and Gynecology; Chairman, Department of Obstetrics and Gynecology, University of Chicago; Chief of Service, Chicago Lying-in Hospital; and *Edward J. Stieglitz*, M.S., M.D., F.A.C.P., Assistant Clinical Professor of Medicine, Rush Medical College of the University of Chicago; Assistant Attending Physician, Presbyterian Hospital;

Attending Physician, Chicago Memorial Hospital; Formerly Attending Internist to the Chicago Lying-in Hospital. Cloth. Pp. 743. Illustrated. Price, \$8.00. Philadelphia: Lea & Febiger Company, 1934.

Thirty-nine authorities, including the editors — an obstetrician and an internist of high repute, have collaborated in producing this very useful contribution to medicine and obstetrics. Heretofore most books on obstetrics have been too brief or very inadequate in dealing with medical complications of pregnancy. This book is therefore a quick answer to the doctor's need when his patient has developed complications that are not intrinsically obstetric in their nature. The authors frequently resort to classifications and thus make a ready means of organizing and digesting a subject that might otherwise have been complex and confusing. Each subject is presented in a thorough and interesting fashion. For example, the chapter on Tuberculosis has such interesting sub-headings as: "Menstruation and Tuberculosis"; "Marriage and Tuberculosis"; "When Pregnancy Is Permissible for Tuberculous Women"; "Maternal Changes in Tuberculosis"; "Influence of Pregnancy on Tuberculosis"; "Treatment of Tuberculosis During Pregnancy"; and "Offspring of Tuberculous Mothers." The chapter on Syphilis is likewise very well presented but here the author might have given a more detailed plan of treatment. "Diseases of the Heart" is a very useful and well written chapter that is not duplicated in any text book of obstetrics. Hardly any complication that may afflict the gravid patient — whether major or minor in its importance — has been omitted. The reviewer has no hesitation in recommending this book to obstetricians and gynecologists, internists, or the lay doctor of medical practice.

PHYSICAL CHEMISTRY OF LIVING TISSUES AND LIFE PROCESSES. AS STUDIED BY ARTIFICIAL IMITATIONS AT THEIR SINGLE PHASE. By *R. Beutner*, M.D., Ph.D., Professor of Pharmacology, School of Medicine, University of Louisville. Cloth. Price, \$5.00. Pp. 337 with illustrations. Baltimore: The Williams & Wilkins Company, 1933.

It has been often pointed out that the road to knowledge is not royal but its attainment within the power of those most persistent. The excellence of this work recalls the sobering experience that quality and high scholarship have often been deterrent factors for mass recognition. This book will wholeheartedly attract a select and understanding minority, but if experience runs true to form, it will be neglected by that majority for whom this exposition bears the greatest educational message — the medical profession. Here, indeed, is a contribution so original in exposition and in basic and essential information for biophysical and medical students, that it should be introduced into the curricula of these

studies as required reading. It brings into clearer light the amorphous and specific data regarding the chemical and physical nature of living tissue and life processes and presents them in that uncolored style familiar in science. The mechanistic point of view is favored by the author, who feels that "life in all its complexity seems to be no more than one of the innumerable properties of the compounds of carbon." He has incorporated the most important data from authoritative sources and has critically evaluated the records of past attempts to bridge the gap between inanimate and living matter, both by laboratory and other means. The text is divided into five comprehensive sections and an index, and approaches the problem from three broad objectives. The first approach analyzes the status of membranes, osmosis and related forces; the second discusses the relative influence of crystallization and surface forces on the colloid state as deduced from experimental models and life processes. The third approach introduces the action and status of electrical currents on animate material. Here the reader is afforded a particularly keen and critical evaluation of the various electrical currents utilized in diagnostic clinical medicine. This section is unquestionably one of the finest in the elucidation of the physics, chemical nature of living tissue and the influence of electricity upon the unit cell, as well as upon nerve and muscle structure. For those who are particularly interested in the physicochemical nature of living matter and the action of electrical currents, this section will be found to be a most scholarly exposition. Every progressive and serious student of physical medicine should read this book because we believe it is the most scholarly interpretation of the basis of our discipline.

OCULO-REFRACTIVE CYCLOPEDIA AND DICTIONARY. By *Thomas G. Atkinson, M.D., B.Sc.* Cloth. Pp. 384, illustrated. Price, \$5.00. Second Edition. Chicago: The Professional Press. 1934.

The student of ophthalmology will appreciate such a book as this for quick reference. It is not a text, yet it contains detailed information on practically every subject pertaining to refraction. With the many advancements in the science of refraction, from the fundamentals to the use of apparatus of modern development, it is sometimes difficult to keep abreast of the times, unless one has in a volume such as this dictionary the information commonly sought for refreshing one's knowledge

quickly. It obviates the necessity of referring to several texts and books on related subjects. Such subjects as ophthalmoscopy and retinoscopy, because of their importance, are treated in elaborate fashion, and while the student requires a wider knowledge than that given, the essentials can be readily grasped. Reference to the basic subjects and to those of the physical sciences with special reference to their relationship to refraction is a practical, interesting and scientific method of presenting the subject in the style which the author has chosen. The book is recommended also to the general practitioner who often finds it necessary to enlighten himself on ophthalmic subjects and especially on refraction. The mechanical make-up of the volume, its style and typography are commendable features.

DAS GLAUKOMPROBLEM UND DIE GLAUKOMOPERATIONEN. By *Müller, Hofrat Dozent Dr. Leopold*, (Vorstand der Augenabteilung im Elisabethspital in Wien). Cloth. Pp. 100. Price Rm. 8. Wien, Wilhelm Maudrich, 1934.

This brochure of 100 pages on glaucoma and its surgical management is very timely. Written in a direct (though too Teutonic) style, well printed in bold type, on good paper, it can be read with ease by the physician who possesses even a limited knowledge of the German language. The anatomic and physiologic aspects of glaucoma receive full and careful consideration. The author is especially insistent on separating true glaucoma simplex — from glaucoma of any inflammatory cause. He states that though Donders and Elshnig and others have already noted this distinction, there has not been sufficient emphasis placed on this phase, although the successful treatment of the disease is so dependent on this understanding. Of great interest is the author's view concerning the success which Von Graefe has had with iridectomy for the relief of glaucoma. He thinks that as the operations were performed without anesthesia the clean iridectomy as performed by operators of today was not the usual result. Instead, because of the pain attendant, and other psychical and physical factors, the roots of the cut iris were not properly replaced and as a result an iridenclesia was actually performed, the operation of choice to date. The reviewer offers only one criticism and this may perhaps be withheld; but, nevertheless, he still objects to the use of initial symbols such as: JGKL to mean glaucoma intermittens and others more obscure.

INTERNATIONAL ABSTRACTS

Clinical and Experimental Experience With Short Wave Therapy of the Brain. L. Horn, O. Kauders, and P. Liebesny.

Wien. klin. Wchnschr. 47:936 (July) 1934.

Horn and his associates relate observations on ten schizophrenic patients who were subjected to short wave therapy of the brain, studies on the brains of rabbits that were subjected to treatment with short waves, and the results of histologic examinations of the brains of two patients with dementia paralytica, who had died eight and ten months after short wave therapy had been applied to their brains. The authors observed deep changes in the brain and its meninges. They admit that the clinical results of short wave therapy are still unsatisfactory in patients with schizophrenia as well as in those with dementia paralytica, but they do not deny that another dosage, perhaps, irradiations at greater intervals, may eventually produce more favorable results. They emphasize that the rules laid down by Liebesny for short wave therapy must be given attention. Liebesny maintains that, in order to obtain a uniform depth action, the condenser plates should be from 6 to 10 cm. away from the head and not 1 or 2 cm., as was the case in most of the experiments. This rule must be followed to influence the deeper portions of the brain. Moreover, an increase in the temperature of the brain should be avoided. This may be possible by reducing the dosage.

Las Ondas de Hertz y su Influencia Sobre la Eritrosinhemolisis. (Hertzian Waves and Their Influence on Hemolysis Due to Erythrosin). A. E. Roffo.

Del Boletín de Instituto de Med. Exp. 32:72 (March) 1933.

Based upon the foregoing experimentations and especially upon the tables 1 and 4, we are allowed to say:

1. The system blood cells + erythrosin is influenced by the short waves.
2. The system blood cells + erythrosin with blood cells of the normal rat, increases the percentage of diminution of the hemolysis compared to the blood cells of the rat with sarcoma, by the action of waves of 2-3 and 15 meters.
3. The waves of 3,20, 5, 10, 18, 20 and 24 meters invert this relation.
4. These waves act more on the system blood cells + erythrosin with cancerous blood cells than with normal blood cells of rats.
5. The percentage of diminution of hemolysis of human cancerous blood cells in the system blood cells + erythrosin, under the action of waves of 2, 2,66, 3,20, 10 and 18 meters is less

than in the systems with blood cells of other conditions.

6. The waves of 2,40, 3, 5 and 15 meters act more on the systems blood cells + erythrosin with human cancerous cells than on the blood cells of other conditions.

7. The cancerous blood cells of patients and rats are much more fragile under the action of the short waves than the normal blood cells and the cells of other conditions.

The tables 2, 3 and 5 show that

1. The application of the waves has a greater influence when the system blood cells + erythrosin is placed into the electromagnetic field of the oscillator. With respect to this influence follow: the second current loop of Lecher's wires for the human blood cells, the first one for the blood cells of rats, then the first current loop for the human blood cells and the second one for the blood cells of rats, and at last, the condenser.

2. The increase in the time of application increases the percentage of the time of diminution of the hemolysis in the system blood cells + erythrosin with cancerous blood cells of patients and rats; but in the systems with normal blood cells of the rat and human blood cells of other conditions, it diminishes the percentage.

3. The last mentioned results are the same, whichever be the place in which the application is performed.

Retinal Detachment. Technical Observations and New Devices for Treatment, With a Specially Arranged Diathermy Unit for General Ophthalmic service. Clifford B. Walker.

Am. J. Ophthal. 1:1 (Jan.) 1934.

The author concludes that three years ago diathermy could have been dispensed with by the ophthalmologist and practically all the numerous valuable treatments which it provides could have been imitated and approximated by other treatments already at hand. Now, it has been definitely established, with the addition of separated retina to the list of diathermic treatments, by the work of Larsson, Weve, and Safar and others that the ophthalmologist can hardly afford to ignore the subject longer from a practical standpoint, or if surgically inclined he should not be without recourse either in office or hospital to at least the more economical diathermic equipment.

While diathermy by micropuncture alone will give the greatest average success with the least labor, trauma, and sequelae of any single method at present, it is not impossible that just the right combination with other methods, such as the Gonin and possibly the Lindner-Guist, may add something to efficiency in certain cases. However, it is more probable that further perfection

and knowledge of the diathermic methods will permit all other methods to be laid aside as second choice.

Very small stops are necessary on micropins to keep them from going too deep, but not insulated stops, with the machine herein described. With the micropins, overdosing does not occur but instead the sclera receives a small but also valuable degree of treatment (Larsson effect), which also widens the mouth of the outlet, giving better and longer drainage. Overdosing may result when the current must be used to pull out insulated pins, especially multiple in type. Therefore, single, noninsulated, cleanable pins, which can be rotated to help removal have numerous treatment advantages with only an insignificant addition of operative time, since in an unobstructed area 12 pins can be placed in about one minute.

Iridium hardened platinum is the best metal for detachable micropuncture pins because it can be perfectly cleaned by heating to redness in the Bunsen flame. It gives off no oxides and produces no siderosis if by any rare accident a particle is left in the eye. It can be used repeatedly without deterioration from cleaning or sterilization.

Reports of loss of micropins without threads attached are numerous as well as instances where insulation collars have broken during use. When the count fails to check and it is uncertain whether the lost pin is in the orbit or on the floor, the question may be difficult to settle without an x-ray photograph. Constantly threaded iridium-platinum micropins without insulating collars have been found to be safe and satisfactory.

Electrosurgery (Action on the Tissues). Arthur H. Burgess.

Lancet 2:1356 (Dec. 16) 1933.

Undamped high frequency current from a triode valve machine produces a clean, sharp cutting of skin similar to a scalpel. There is no visible charring or coagulation of the edges to the naked eye, and with only just enough microscopic coagulation to seal up the lymphatics and capillaries, and to "cap" and obtund the sensory nerves. Such an incision can heal by the most perfect primary union, leaving a scar indistinguishable from that after a scalpel incision, and with decidedly less pain during the healing process. For deeper tissue cutting slight coagulation effects are observed and healing is not by primary union. These deeper tissues are divided more quickly or more slowly than the skin according to their comparative resistance, the fatty tissue being the most resistant and the slowest therefore in division. Time is gained by increasing the strength of the current when dividing the resistant tissues, and this is especially noticeable in the "radical" breast operation, where the extensive undermining of the skin-flaps has to be carried out entirely in the plane of the resistant superficial fat. Muscle is definitely less resistant

than the skin, and for its division the current should be diminished, as otherwise muscular twitchings from "undertones" of the oscillations, may hinder progress. Cartilage has little resistance and can be divided with the greatest ease, while bone is so highly resistant that, although it may be "cooked" and rendered friable, it cannot be cut. Liver and kidney offer but slightly greater resistance than the skin, and incisions made into them with the cutting current heal well. Moreover, the tissues in the immediate vicinity of the incision seem to be rendered less friable than is normal, so that these incisions can be sutured more firmly and more accurately than those made with the scalpel, besides showing definitely less hemorrhage.

Since it is more important to obtain good cutting and primary union of wounds, the future lies with the triode valve apparatus. This type has the advantage of lower consumption of current and greater output, yielding more than double the wattage of the best spark-gap machine for the same amperage and voltage fed into it; moreover, it is quite silent while a spark-gap is always more or less noisy, no odor of ozone or oxides of nitrogen is emitted. Theoretically the ideal would be the use of both types, in order to cut and coagulate at the same time. Where a large mass of tissue has to be removed it is better practice to excise it with the cutting current and employ the coagulating current to arrest hemorrhage from the cut surface. Vessels of any size, however, require to be picked up with artery forceps and, at the conclusion of the operation either ligatured in the ordinary way or "coagulated" by lifting the forceps away from contact with any other instrument or tissue and touching it for a few seconds with the electrode charged with the coagulating current. Single, small spouters in the course of dissection may be seized with the teeth of the dissecting forceps usually held in the left hand and coagulated by touching the forceps with the coagulating current. This closure of vessels by coagulation can be effected very rapidly as compared with ligation, and in an extensive operation such as that for breast carcinoma considerable time can be saved. It is preferable, however, to ligate branches divided close to a large parent vessel, such as the axillary, since, although they can be securely closed by coagulation yet there is a risk that the process may occasionally extend to the junction with the parent trunk, and result either in its thrombosis or in secondary hemorrhage.

Successful Treatment of Vitiligo—With Report of a Case. Normal Burgess.

Brit. J. Dermat. and Syph. 46:313 (July) 1934.

It has for long been taught that vitiligo is an incurable condition, and that nothing can be done to relieve it, apart from staining the depigmented areas or removing the hyperpigmented margin.

Cohen (Arch. Derm. and Syph., 1934, 28:215) has recently reported the successful treatment of this condition. He gave his patient in-

travenous injections of gold sodium thiosulphate 0.1 grm. once a week. The patient was told to apply a 10 per cent alcoholic solution of oil of bergamot to the affected areas twice daily, and ultraviolet irradiation with the carbon arc lamp was applied to the affected part twice a week. The condition cleared up completely and has not returned within a year of the last treatment.

Similar treatment was adopted in the following case with a very satisfactory result:

E. P., a girl aged 13 years, was first seen at the Bristol General Hospital in August, 1933. She stated that a white patch was first noticed above the left eye one month previously and had increased in size. On examination patches of vitiligo were noticed above the left eye and on the right temple. She was instructed to apply a 10 per cent alcoholic solution of oil of bergamot to the affected parts twice a day. Sanocrysin, 0.05 grm., was given intravenously once a week, and the affected parts were exposed to ultraviolet light from an air cooled mercury vapor arc lamp weekly. The surrounding skin was protected from the rays and only the leucodermic areas exposed. Pigmentation had begun at the end of three weeks, but the full treatment was continued for another seven weeks. At the end of this time pigmentation was complete, but it was thought advisable to continue the applications of light and oil of bergamot for another three months. The condition has not recurred up to the present time.

Effect of Temperature on Nasal Cilia. Arthur W. Proetz.

Arch. Otolaryng. 19:607 (May) 1934.

By means of an apparatus constructed for the study of cilia in the sinus of the living rabbit and described elsewhere (Ann. Otol., Rhin. and Laryng., 42:778 (Sept.) 1933), determinations for temperature were made on freshly removed human mucosa and checked against similar ones made on living rabbits. The results were recorded in cinematographs made at normal speeds.

The frequency of heat was greatest between 18 and 33 degrees C. and varied from seven to ten per second. Controls were maintained at room temperature, which varied from 25 to 30 degrees C. All the experiments were begun with the membrane at 30 degrees C. The temperature was then reduced very slowly and the speed of the cilia noted. At 18 degrees C. there occurred a slight diminution of rate, which progressed with reduction of temperature until in various specimens all motion ceased at points between 7 and 12 degrees C., the lower temperatures predominating in the sinuses of the living rabbit. Owing to the heat supplied by the animal itself and to the difficulty of observing the cilia while keeping the area at a low temperature, this lower figure is only approximate.

When the temperature was gradually raised, motion was resumed, and by the time the thermometer registered 18 degrees C. it was extremely rapid—much more rapid than at the beginning of the experiment, reaching ten or

more per second. This frequency gradually reached the normal once more as the temperature continued to rise.

The practical inferences are twofold: first that the respiration of cold air does not damage the cilia, especially in view of the fact that inspired cold blasts are constantly alternated with expired ones at 37 degrees C., and second, that if for any reason whatever hot nasal douches are indicated, their temperature should not exceed 40 degrees C., if the cilia are to remain unharmed.

Ultraviolet in Dentistry. Albert Bachem.

J. A. Dent. A. 21:302, 1934.

A method is developed by which the transmission of monochromatic light through biological tissues can be determined with exclusion of systemic errors. Transmission figures demonstrate the energy distribution in human skin, dentine, enamel, cement and buccal mucosa for ultraviolet, visible and infrared light. A discussion of the quantitative data available for the erythema producing, bactericidal and antirachitic effects leads to the conclusion that ultraviolet light is of particular usefulness in the field of dentistry. A short review of the lamps designed for local and general application of ultraviolet is given.

The Influence of Radium, X-Rays, Ultraviolet and Heat Upon Mitosis in Tissue Cultures. J. Juul, and T. Kemp.

Str. Ther. 48:457, 1933.

From a large series of well arranged observations on tissue cultures of chicken fibroblasts the authors find that radium, x-ray and ultraviolet exposure produce similar results. Within the first hour a pronounced decrease of the number of mitoses occurs; later this number increases again, but remains below normal figures. Cells which had started mitosis at the time of exposure go through with it, but new mitoses are not started. Heating of the cultures causes also a decrease of the numbers of mitoses, but a subsequent increase up to supranormal figures. The mitoses present at the time of exposure are not completed, and no new cells enter into mitosis. From these and more detailed studies the authors conclude the irradiation primarily and selectivity affects the nuclear chromatin, while heating causes alterations in the protoplasm and if applied excessively, damages the cell as a whole.

Ultraviolet Sensitivity and Menstrual Cycle. H. Guthmann, and W. Nagel.

Str. Ther. 48:267, 1933.

In 21 out of 41 cases an increase of the intensity of erythema was observed before and on the first day of menstruation. A pronounced decrease occurs during menstruation. The ultraviolet sensitivity variation corresponds to the variation of the Kations (Ca, K, Fe) in the blood. The same factors may account for menstrual and premenstrual dermatoses, such as herpes, urticaria and acne.

The Bactericidal Effects of Monochromatic Light.
O. Ehrismann, and W. Noethling.

Ztschr. f. Hyg. u. Infektions-Krankh. 113: 597, 1932.

The energy of monochromatic ultraviolet radiation required to destroy 1 to 10 per cent and 90 to 100 per cent of bacteria is determined for various wavelengths, different bacteria, and variable time and intensity factors. In contrast to the findings of other authors no effects are noticeable for 366 m μ , varying somewhat for different bacteria. As a rule smaller bacteria require smaller energy densities. The Bunsen Roscoe law holds true for an intensity ratio of 1 to 28.7 and up to 100 minutes exposure time. The spectral absorption curve of bacterial emulsions resembles the sensitivity curve, but no direct quantitative relationship is evident.

The Systematic Determination of an Optimal Rhythm for X-Ray Therapy of Malignant and Benign Diseases. Holfelder.

Fortschr. a. d. Szeb. d. Roentgenstr. 48:105, 1933.

Eliminating problems of secondary importance one arrives at this fundamental problem of x-ray therapy: which temporal distribution of the total dose has the greatest elective action upon the particular tumor? The systematic study of this problem has lead to the following scheme:

Total treatment time for every tumor:

Lymphogranulomatosis, 10-15 days.

Soft tissue sarcoma, 2-3 weeks.

Bone sarcoma, 3-6 weeks.

Larynx and pharynx tumors, 3-4 weeks.

Mamma Ca, 10-20 days.

Intestinal Ca, 4-6 weeks.

Ca metastasies, 2-4 weeks.

Total doses per tumor, 1600-4000 r (primary rays).

Partial doses:

1st day, 270-300 r.

2nd day, $\frac{3}{4}$.

Later, $\frac{1}{2}$.

Finally, $\frac{1}{2}$ of the 1st partial dose.

Intervals: In first 2 to 3 weeks, 1 day. Toward the end, 2 days.

Coutard's method was tried, but abandoned again on account of poorer results. Protracted dosage has no advantage. This treatment scheme, combined with Holfelder's cross fire method has been in use for 7 years and gives excellent results.

Effect of Diet and Ointments Upon Erythema and Pigment Formation. Th. Kittel, and R. Stahl.

Str. Ther. 48:283, 1933.

Erythema and pigmentation are increased by acid, decreased by alkaline diet in comparison with the effects obtained after neutral diet. After an intermediary alkaline or acid diet the effects of an acid or alkaline diet is not so pronounced or may be missing entirely. While salves as a rule protect the skin against ultraviolet light, the effect of an acid salve was decidedly stronger than that of an alkaline salve.

Production of Pain in Exercising Skeletal Muscle During Induced Anoxemia. M. Kissin.

J. Clin. Investigation 13:37 (Jan.) 1934.

Kissin induced a progressive generalized anoxemia in eight normal subjects by having them rebreathe the air from a 20-liter tank connected in series with an 8-liter spirometer. The accumulation of carbon dioxide was prevented by passing the expired air over soda lime. As a control, each subject, while breathing room air, repeated his exercise at the same rate and as nearly as possible in the same position as in the anoxemia experiments. The author observed that generalized anoxemia without ischemia can induce pain in an exercising skeletal muscle. Within certain limits the severity and rapidity of onset of the pain varies with the degree of anoxemia and with the rate of exercise of the muscles involved. The pain appears to be due to accumulation of products of muscular metabolism that require oxygen for their disposal. — [Abst. J. A. M. A. 102:1336 (Apr. 21) 1934.]

The Effects of X-rays Upon Tissue Cultures. H. C. Andersen, and M. Fischer.

Str. Ther. 48:500, 1933.

The effects of x-rays on tissue cultures correspond in principle to those caused by γ and x-rays:

- (1) A decrease of growth dependent upon the intensity of the radiation (Th X for 2 to 3 days).
- (2) The existence of a well marked latent period.
- (3) The absence of any stimulation even at minimal dosage.

IMPORTANT NOTICE

Several copies of the January 1934 issue of the Archives are needed by the Editorial Office. Fifty cents per copy will be paid if mailed to

AMERICAN CONGRESS OF PHYSICAL THERAPY
30 North Michigan Avenue Chicago

TEMPERATURE DETERMINATIONS DURING LOCAL APPLICATION OF DIATHERMY *

(A Preliminary Report)

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23

The term "diathermy" was adopted to explain the thermal action of high-frequency current upon animal tissue. It was thought that this type of current caused an elevation of temperature of the material through which it traversed. During recent years scientific investigations of the actual temperature developed in the animal body as a result of the application of diathermy have tended to give the impression that such elevation is very slight if indeed at all. The investigation of Binger and Christie⁽¹⁾ showed that following the application of diathermy through the thorax of dogs the temperature of the lung was elevated not more than 0.4 degree above that recorded for the rectum. When the pulmonary artery was occluded, the rise in temperature in the lung tissue supplied by the artery was much higher.

Studies by Bettman and Crohn⁽²⁾ threw further doubts upon the ability of diathermy to create interior heating. For this they used mixtures of agar-agar and albumin arranged in a sausagelike mass, and deduced that the action of this type of current was essentially a surface one.

Cumberbatch,⁽³⁾ Stenstrom and Nurnberger⁽⁴⁾ and others showed that a substantial temperature elevation was produced on the skin surface during the application of diathermy. That the skin surface does become warmer during the application of diathermy can readily be determined by anyone who has sufficient curiosity to place his hand upon the skin during the course of a treatment.

Temperature Determinations by Thermocouples

We made determinations of the tempera-

ture produced on the skin surface and underneath it during the application of diathermy by means of thermocouples. We employed both the parallel plates and cuff technics.

Plates of the usual composition metal were applied to the region of the mid thigh on its internal and external aspects. The internal plate was $5\frac{3}{8}$ by $7\frac{1}{4}$ cm. The external plate was $2\frac{1}{2}$ by $4\frac{1}{4}$ cm. These plates were held in position by means of an elastic bandage. The diathermy current was introduced so that the hot wire milliammeter first registered 500 ma. After eight minutes the current strength was elevated to 800 ma. and permitted to stay at this level for about 20 minutes longer. The temperature of the surface of the skin underneath the smaller plate was measured by means of a mercury thermometer inserted between the plate and the skin surface. Previously the temperatures recorded by this method were compared with temperatures determined by means of an alcohol thermometer and a thermocouple. These determinations corresponded with each other. To discover the subcutaneous temperature a hypodermic needle, containing the thermocouple junction enclosed with a glass capillary tube, was inserted into the skin at a distance of 1 cm. from the upper edge of the metal plate and buried for a distance of 13 mm. ($\frac{1}{2}$ inch). The thermocouple needle was held so that its tip was underneath the electrode and at a distance of about 0.5 cm. from it. We were aided by our physicist, Mr. Schwarzschild, and his staff, in observing and recording these temperatures, and also in checking the accuracy of our apparatus. We also made certain that the current transversing the tissue had no direct heating influence upon the needle. This was done by applying the diathermy current to a piece of meat into which an alcohol

From the Physical Therapy Department of the Beth Israel Hospital, New York City.

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 12, 1933.

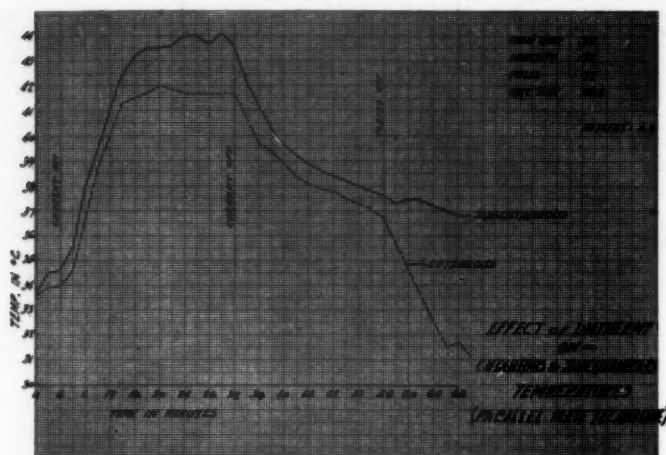


Fig. 1.—Relative heat penetration in degrees centigrade when parallel electrodes were employed.

thermometer, a mercury thermometer and the thermocouple needle were inserted. The readings recorded by these various means all agreed.

Cutaneous and subcutaneous or intramuscular readings were made for an interval of several minutes before the current was turned on. The subcutaneous temperature showed a slight tendency to rise directly after the insertion of the needle, due probably to the inflammatory reaction evoked by the presence of the foreign body. The cutaneous temperature rose to 42 degrees C. from the original level of 33.6. The subcutaneous temperature rose from 33.8 to 44 degrees C. The temperatures persisted at about these levels until the current was discontinued. It then fell at first sharply and then more slowly.

The cutaneous temperature cooled more rapidly when the plate and bandage were removed.

To determine the temperatures produced in the tissue intervening between two metal cuffs, strips of composition metal were made to encircle the leg a short distance above the ankle and below the knee. The distance between the cuff edges was six inches. A thermocouple needle was inserted midway between these edges to a depth of one inch into the muscles of the calf. Temperature readings were made of the tissues surrounding the tip of the needle and also on the skin surface in the regions near the cuff edges and midway between them. The current strength at the start was 600 ma. This was raised to 800 ma. after a period of eight minutes. The intramuscular temperature gradually rose from

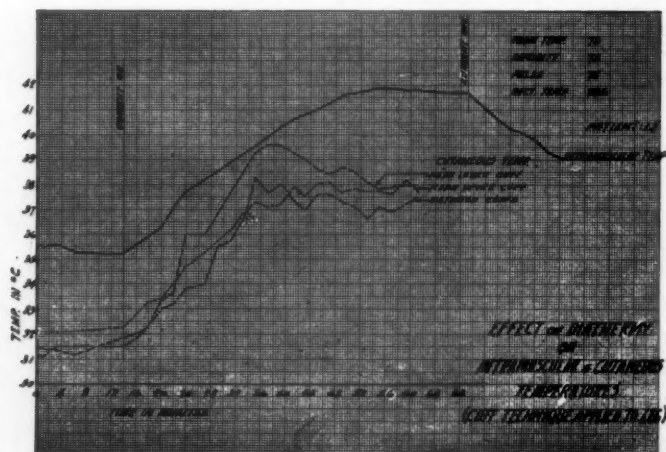


Fig. 2.—Relative temperature variation when cuff electrodes were employed.

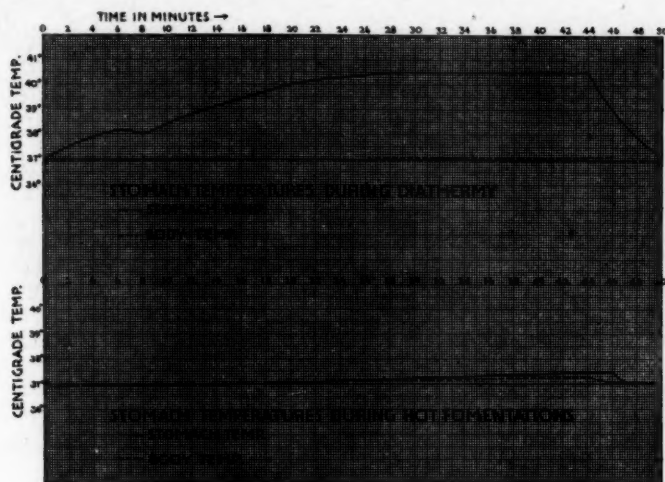


Fig. 3.—Relative temperature variation of diathermy and hot fomentations over stomach region.

35.2 to 42 degrees C. The surface temperature of the skin near the upper edge of the lower cuff rose from 31.6 to 39.6 degrees C. The surface temperature of the skin near the lower edge of the upper cuff rose from 32.2 to 38 degrees C.; while the temperature of the skin area midway between the cuffs rose from 31.6 to 38.4 degrees C. After reaching these levels, the temperatures fell about one degree and so remained during the course of the experiment. The higher skin surface temperature readings near the lower cuff electrode are explained by the fact that the circumference of the leg near the ankle is less than it is below the knee; hence the greater current concentration at the upper edge of the lower cuff.

It is of interest to note that a substantial elevation of temperature occurs not only on the skin surface but also in the subcutaneous and intramuscular areas when employing the cuff technic for the administration of diathermy.

Evidence that there is a definite temperature increase in the neighboring tissues during the application of intravaginal diathermy is shown by the following observations: Working with Drs. E. A. Horowitz and D. Derow, we have frequently found temperatures as high as 41.5 degrees C. in the urethra; 44 degrees C. in the rectum and 42 degrees C. in the cervix when the temperature of the tissue surrounding the vaginal electrode was 44 degrees C. Other investigators, such as Royston⁽⁵⁾ and his co-workers, and Gelhorn,⁽⁶⁾ have made similar observations.

Temperature Variation of Stomach

In determining the stomach temperatures, an attempt was made to repeat the experiment somewhat similar in technic to that originally performed by Bordier⁽⁷⁾ of France, who was able to increase the temperature of the stomach 2.6 degrees C. In this study we are indebted to Dr. Paul Roth and his assistants for help in the scientific management and for the recording of the temperatures in the gastric experiment.*

The determination of the temperatures in the stomach during the application of diathermy was made by means of a thermocouple swallowed in a stomach tube. The patient was then fluoroscoped to check the location of the thermocouple and given a little barium to determine the stomach location. The patient was in a prone position with two block tin oval electrodes—anteriorly 12.5 by 18.7 cm., posteriorly 15 by 22.5 cm. The plates were moistened with a paste and applied to the surface, so that the area of the stomach was between them. They were held in place by elastic bandages and lightweight sand bags.

Preliminary readings were made to determine whether the high-frequency current effected the readings of the thermocouple in the stomach. There seemed to be a negligible variation in the temperature reading. However, during the experiment the diathermy current was momentarily turned off while the readings were taken.

* We are indebted to Mr. Roy Hayes of the Battle Creek Sanitarium electric department for the construction of the thermocouple used in these gastric observations, also to R. W. Beeden who acted as the subject and swallowed the thermocouple.

The hot wire milliammeter first registered 1500 ma. This was gradually increased after 2 minutes to 3200 ma. The stomach temperature rose from 36.9 degrees C. to the peak temperature of 40.5 degrees C. in 28 minutes. At the end of the sixth minute there was a slight drop of one-tenth of a degree, which was perhaps due to circulatory changes. Several readings were taken at the maximum temperature of 40.5 degrees C. When the current was turned off, the stomach temperature returned very quickly to 37 degrees C.

The patient had on no clothes, which probably added to his comfort and to the heat radiation. The patient began to perspire in about 7 minutes. There was an increase in body temperature during the experiment of two-tenths of a degree. The experiment was repeated three times. The same maximum results were obtained twice; in the third experiment, the maximum temperature obtained was 39.4 degrees C. On one occasion there was a slight burn anteriorly at the end of the electrode along the costal margin.

By applying diathermy with anterior-posterior electrodes to the stomach area, the temperature in the stomach was increased 3.6 degrees C. above that at the beginning of the experiment, and 3.4 degrees C. above the body temperature. The increase was gradual up to the maximum which was reached in 28 minutes. When the current was turned off at the end of 44 minutes, the stomach cooled off rapidly to body temperature.

Summary

We are not attempting to evaluate the physical consideration involved in the application of the diathermy current nor the physiological response of tissue to the introduction of this type of high-frequency current energy. Our purpose is to indicate the actual temperatures which we have observed in certain human body tissues during the application of diathermy. These observations have definitely shown that it is possible to create a substantial increase in the temperature of the tissue traversed by the high-frequency current during the application of local diathermy.

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Discussion

Dr. William Bierman (New York): We ourselves were surprised to find that with the ordinary technics as employed in diathermy we could secure very substantial elevations of temperature on the skin, underneath the skin, in the muscles, and in other internal organs, as in the stomach, thorax and abdomen when applying the electrodes in the anterior-posterior position as Dr. Tarbell indicated, and in the neighborhood of the orifices during the application of intravaginal diathermy.

In practicing physical therapy and diathermy, I for one always have been apt to explain the results secured on the basis of active hyperemia in the body's attempt to remove this energy which would otherwise be translated into heat, rather than upon any definite elevation of temperature, and those studies indicate that this concept was erroneous, that you really do secure elevations amounting to as high as 10 degrees centigrade in subcutaneous tissue.

In the employment of the cuff technic, the cuff was applied just below the knee and above the ankle and the thermocouple needle inserted midway between. That is three inches away from the nearest metallic edge, and at a depth of one inch, and yet in spite of that, we were able to make a temperature determination indicating levels as high as 42 degrees centigrade. These findings very definitely indicate that we have no reason to be apologetic in explaining the effects of diathermy, and they certainly can be explained on the basis of very definite, substantial temperature elevations in the tissues traversed by the current.

We have not discussed the variations in resistance and variations in temperature, but in the structures which we definitely have observed, that holds true.

Dr. Disraeli Kobak (Chicago): There is hardly need to point out that this concise report is of primary importance, for it deals with the very keystone upon which diathermy has based its supremacy. If heat is the *vis a tergo* that sets into motion the complicated mechanism of active hyperemia and the metabolic changes associated with the reconstructive efforts of the body, it is important to know whether this form of appli-

cation is perithermic, epithermic, or diathermic. There is a vast difference between the physiologic effects obtained by the types of heat just enumerated and it is important for us to know whether high frequency current actually or theoretically produces deep heating action in living tissue when confronted by a mobile circulation.

That this phase of the problem has been the very crux of this discipline is indicated by the fact that all the names applied to medical high frequency have been associated with the concept of its heat penetrating powers, or its ability to promote temperature elevations of the deeper or underlying parts. Thus it was first described by von Zeynek and coworkers as "thermopenetration" and by Nagelschmidt as "electrotrans-thermy," and later as "diathermy." Delherm and Laquerrier described this peculiar phenomenon as "endothermy." As regards the thermopenetrative powers, Grunspan and Levère (1913) showed that high subcutaneous temperatures could be elicited after diathermy treatment (42 degrees C.). Santos demonstrated a rise in temperature in the urinary bladder (45 degrees C.) of a patient when the latter was subjected to an hour of diathermy. Fürstenberg and Schemel studied the internal temperature of the stomach in a manner similar to that which has been described today. With 3 amperes of current they were able to show an increase of 0.3 degrees and with 2 amperes, 0.1 degrees C. The fact that they were unable to obtain higher temperatures with greater amperage (the internal heat fell with increasing amperage) prompted Lüden independently to study this phenomenon and he showed that the temperature rise varied in direct proportion to the amperage. The maximum curve showed an increase from 37.5 to 38.8 degrees C. within a period of 80 minutes. One can also by means of x-ray and barium meals demonstrate the influence of peristalsis of the stomach and intestines. Time will not permit me to mention the rich literature already existing on this phase of diathermy in relation to demonstration of deep heating effects in other parts of the body. To read the literature on this subject is to convince one's self that no one need be surprised that much of this field of investigation has been thoroughly studied, but rather that anyone should doubt the sterility and the inactivity of our pioneers in this important branch of investigation. However, one can never have too many confirmatory reports, because to doubt is to learn, and truth can always stand repetition.

Dr. Heinrich Wolf (New York): I have tried to establish the amount of temperature elevation in the rectum after treatment of diathermy, and I found, using very crude methods, with the ordinary thermometer, that after the treatment the temperature goes up to about 103 degrees. Naturally, in the interval of time before the application of the thermometer, the temperature was reduced.

We have another proof of the resistance of

fatty tissue. If one uses diathermy current of too intense a degree, one sometimes finds that tumors develop in the fatty tissue. I read such a report only a few days ago. These tumors are nothing but coagulated fatty tissue, because the fat has this very high resistance and it can't be heated up much more than the tolerance of the skin. I think that is proof that variable resistances are encountered which influence the underlying temperature of the structures diathermized.

As far as the experience of Drs. Bierman and Tarbell is concerned, I am not quite certain that the temperature will go much deeper than one inch with the method as demonstrated by them, because, after all, we have here a rather limited surface and if you put the thermometer under the cuff, you will see it is in the course of the current. The temperature of the skin has gone up proportionately quicker than that of the tissue beneath, but at any rate, the skin irradiates the heat and the temperature of the skin is reduced on account of surface evaporation. It is a question whether one would have gotten a similar elevation with a cuff method, if they had measured down, say two inches, because it seems to me that according to the classical idea of diathermy, one can not obtain the temperature elevation in these deeper tissues with the cuff method. The interesting part certainly is that one obtains with the cuff method a much deeper penetration than originally anticipated.

Dr. Richard Kovács (New York): I would like to add that some observations have been made in connection with hyperpyrexia studies by short waves at Polyclinic Hospital, where thermocouples held to the skin, inserted into the muscular tissue, and in the cubical vein were used. The interesting observation was made that the muscle temperature was in each case two degrees higher than the temperature of the skin, and the intravenous temperature was lower than the muscle temperature, showing that the circulating blood will always cool the surface.

I would be very much interested if either Dr. Bierman or Dr. Tarbell or someone else, would make investigations and present more definite data as to whether the old conception that the heat production is due to Joule's Law, to the electrical resistance of tissue, or whether the recently advanced conception, which seems to be more probable, is actually true, that the heat reduction is due to dielectric hysteresis.

Dr. Luther A. Tarbell (New York): We were not trying to do anything new in this experiment. We know this work has been done by Bordier and others. We were simply trying to check up on some of these experiments from a little different angle. It was not our mission to determine whether heating the stomach is a beneficial therapeutic agent, but we did try to measure accurately various temperatures and present them to you.

NEWER CONCEPTS IN COLON THERAPY *

WM. W. WORSTER, A.M., M.D.

SAN GABRIEL, CALIFORNIA

Ever since the dawn of modern civilization, constipation has been one of the maladies from which man has constantly sought relief. Of the various methods employed, some have proven efficient and reliable, some have been found worthless, and others even detrimental.

Among the numerous remedies advocated, rectal injections have always been a very popular and prominent measure. The enema invariably brings relief, but only in few instances produces a permanent cure. Its effect is dependent upon two fundamental actions—first, the softening of the feces by the water, and second, the assisting in the expulsion of the bowel content by the contraction of the muscular walls of the bowel after the pressure of the water has temporarily stimulated them.

On first thought this latter action seems advantageous, and so it is—for occasional use or immediate relief. But on further consideration it is found inadvisable for routine use, because of the wrong principle upon which this method provokes its effect. This form of treatment does not possess the virtues of changing a chronically dilated bowel to a normal calibre, the tendency of the routine enema being to dilate it still more, thus augmenting the pathologic state instead of abating it.

An attempt to improve the technic and make it more effective was the aim of the so-called "high-enema." The many benefits claimed for it by its advocates have proven disappointing on critical study. In most instances the tube would coil in the sigmoid, and the results were found less efficient than from the plain enema.

The enema cleanses to the splenic flexure and, occasionally, to the middle of the transverse colon. The cecum and ascending colon very seldom, if ever, are emptied by this method. Modern research has demonstrated that germ growth is great-

est in the cecum. The bacteria tend to die as the feces become formed and this becomes more evident the farther along the bowel the test material is taken. In fact, it is probably from the cecum that the greater percentage of absorption takes place. Therefore, to get the full benefit of any colon therapy it is necessary to cleanse the entire large bowel.

Schellberg contributed the first real advance by perfecting a method to satisfactorily cleanse the entire large bowel. His technic consisted in the use of a long, rather large rubber tube. By skilful manipulation, he could often pass it into the cecum. A disadvantage, however, lies in the fact that few are successful in reaching the cecum. Another disadvantage is the liability of puncturing an ulcer or diverticulum. This seldom occurs, but when it does is very serious and often fatal.

In order to avoid the possibility of a perforation, one should insert the tube not more than six inches, and to avoid dilatation of the bowel one should not use more than one-half pound of pressure at any time. This is about one-fourth to one-half the pressure of the ordinary enema. The x-ray will easily demonstrate that only one-half pound of pressure is required to fill the entire large bowel.

Value of Negative Pressure

After the bowel is filled, how can the water return without the aid of the contraction of the acutely dilated bowel? The answer is by use of *negative pressure*. Instead of dilating the bowel beyond its present diameter, one can fill it without stretching. The negative pressure is used on the return flow with not more than an equivalent of two inches of suction. This greatly assists in emptying the bowel and has a great tendency toward bringing it to a normal state. Although the actual contraction at each treatment may be so small that it can not be measured, yet after a course of treatments, in many instances, it can be actually

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 15, 1933.

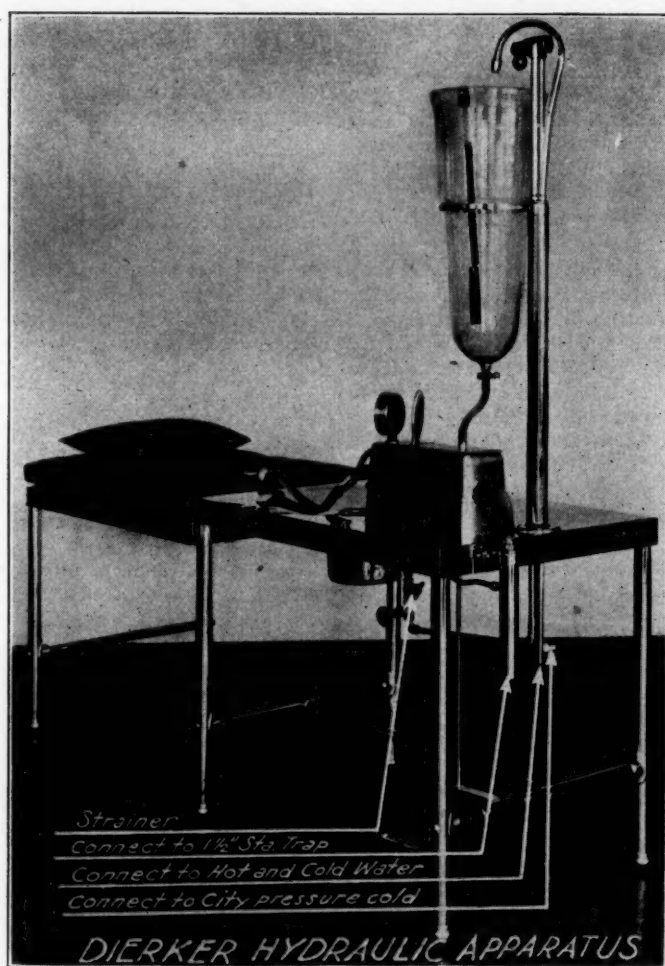


Fig. 1 — This apparatus must be regarded as a distinct advance in colon therapy. Its greatest recommendation is simplicity of operation and clinical effectiveness.

demonstrated by the x-ray. If the bowel does not return to normal, this treatment at least does not enlarge it.

Another very valuable principle, is that of delivering a massage effect directly to the bowel wall by using alternate pressure and suction which provides a much needed tonic action to the bowel. This so-called hydraulic massage can be used to soften fecal impactions and also to wash out concretions and deposits that have lodged in the folds of the bowel, thus making the cleansing more efficient. The combined action, then, is to thoroughly cleanse and tone the bowel.

The Dierker apparatus made by the Von Corporation of Los Angeles, is so constructed that it can be used for the ad-

ministration of the above treatments. It has a gauge and a control that accurately determine the pressure and suction. During the time it has been on the market no damage to any bowel has been reported, but hundreds of cases have been greatly improved.

It is not within the scope of this article to enter into the therapeutics of colon therapy, but in closing it might be stated that no claim is made that colon therapy is a panacea for all diseases. In many chronic cases which do not respond to other methods of treatment, it is well to give it a trial. The oftener it is scientifically used, the sooner it will find a permanent place in the office routine of the medical profession.

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Discussion

Dr. Anna W. Hagemann (Cincinnati, Ohio): Colonic therapy is a subject which is attracting more attention each day, as is evidenced by the greater number of cases diagnosed "colitis" and the feverish search for mucus solvents. This term embraces all agents, medicinal and physical, looking to overcome the intoxication and the toxemias due to intestinal infarct.

The first and most urgent thing to do is to get rid of the offending material in the quickest way commensurate with the safety and comfort of the patient. Colonic irrigation properly administered meets these requirements, and it is a foundation for the treatment of many diseases remote from the colon itself. The technic used will differ even as technics differ in every other therapeutic endeavor. The qualifications for proper colonic irrigations are a knowledge of the physiology and anatomy of the colon as well as the effect of medicinal solutions used, proper equipment, experience, and care in manipulation.

To my mind the watchword should be: Treat the bowels gently. With these prerequisites the field for work along this line is unbounded, and it is unfortunate that there are still some physicians who either have not taken the trouble to investigate, or who have not seen the best results and advise against it.

While colonic irrigation is not a cure-all, and in a great many, perhaps most cases, should not be looked upon as a complete treatment, it is often hard to convince patients that they need further treatments when the skin clears up and they are relieved of such symptoms as nausea, headache, dizziness, lassitude, depression, wandering pains, et cetera.

There are morbid conditions which, with a clean intestinal tract as a foundation, will invariably be benefited if supplemented by any rational system of treatment. In other words, these conditions are colonic cases plus an unknown variable, and examination should lead to discover this plus defect. The cases which have responded most surprisingly in my own practice are recurring headaches, particularly of the migraine type, which have been completely relieved. I have also observed satisfactory relief in obstinate skin diseases even when they have been of years standing. In arthritis I have arrived at the conclusion where I can predict that these affections can be arrested and pain relieved.

Among the causes of colitis I should like to mention dietetic fads, such as filling the bowels with roughage and fiber. Unless one is sure that there is no irritation of the bowels or colitis, it seems to me that patients should be warned that they had better stay on a normal, reasonable diet. I give a few simple rules to my patients: Never eat what you know hurts you. Never eat too much. Try to have agreeable surroundings, and pleasant thoughts, free from emotional upsets at meal time. A good laugh at a meal is a fine digestant. I tell them that if these rules fail it is time for them to go to a reputable doctor who will diagnose their difficulty and offer them

proper advice. I also urgently advise them not to follow the advice of those who exploit this or that theory, usually without any knowledge of dietetics, and certainly with no knowledge of their needs.

Dr. E. L. Cartwright (Fort Wayne, Ind.): I should like to have Dr. Worster tell us how much psychic therapy has to do with colonic irrigations. It certainly must have some, as well as simply emptying the colon. I should also like to know whether or not Schellberg was a physician. I have heard that he was not, but I am not certain. I heard that he acquired his experience working in a Turkish bath house.

Chairman Wiltsie: If you will pardon me for speaking now, I think I knew Schellberg personally probably better than anyone here, and I enjoyed rather a warm friendship with him for the last three or four years of his life. Schellberg was not a doctor. He was a trained nurse. He was not a bath attendant, and never had been. He was a trained nurse, and he was scientifically trained. There is no question that Schellberg knew modern science. He studied all the fundamental sciences. He was well versed in modern chemistry, biology, and bacteriology. He was a gifted artist and painter, but above all I think his eminence is due to the fact that he was a technician. He was a creative student and a remarkable technician in methods of colon irrigation therapy. It is to his credit that he revived the art and contributed a life time of creative effort to this field of therapy.

Dr. C. F. Voyles (Indianapolis, Ind.): I should like to know if in his experience he has found spasticity quite an irritable condition of the colon in a high percentage of cases, and if these spastic cases are suitable for colonic irrigation.

Dr. F. W. Willis (Chicago): I should like to have Dr. Worster inform us regarding the apparatus used at the Battle Creek Sanitarium. It is an electrically constructed instrument that operates by stimulating peristalsis and muscle contractions. I am wondering whether my results with this machine are, or can be as good as with the rational method and simple apparatus described by the essayist.

Dr. J. C. Cutler (Newport News, Va.): I should like to go over my early experiences with colonic irrigation for Dr. Worster's criticism. I am satisfied that in one case at least I managed to convey the fluid from my irrigator into the cecum, because my patient, who had been complaining of chronic appendicitis, came back two or three days later quite sick. I began with a small container of 500 cc. capacity. I attached the colon tube to it. I put the patient on his left side, and lowered the head of the table six inches or less. With a nurse holding the tube and handling the water container and the little pitcher to pour the water in, I manipulated the tube. I inserted it very slowly, let the water run in ahead of it. Sometimes I am able to insert it four inches and sometimes 14 inches. However, with the patient's head down, I think that

I am quite sure to get the water around into the cecum. As soon as the patient complains of pain, the nurse lowers the container and she lets the water run back into the sink. Filling it again and emptying it again, and so on. I find that after 5, 10, or 15 minutes the patient will be able to retain from a quart and one-half to two quarts of water, without any trouble. Then I allow the patient to evacuate the bowels.

Chairman Wiltsie: Dr. Worster says that by his method he empties the cecum, as he has proven by the x-ray. I want to know whether he feels that he gets his water over into the cecum, or whether he feels that it is the transport mechanism that has stimulated to empty the cecum.

Another point he mentioned is the fact that he reduces the caliber of the bowel by the suction. We know that the caliber of the ascending colon in the cecum naturally reduces itself very strongly. What we are really after is to reduce the caliber of the cecum, the ascending colon and the transverse colon. If he is operating with a small tube, and if by any chance there should be any physiological sphincters between the transverse colon and the sigmoid, or if the angulation of the splenic flexure should interfere with the suction, does the doctor feel that he can reduce the caliber of the cecum and the ascending colon?

Dr. William W. Worster (closing): I consider the unusual interest in this topic an index of the wider interest that colonic therapy has aroused throughout the world. It would appear from the discussions that the profession is woefully ignorant, suspicious and at the same time tolerant to any new advance that may be pointed out by means of colon irrigation for many intractable conditions. I have attempted to present the principles of a new method and a new apparatus from a conservative and critical standpoint. The method insures against traumatization of the delicate parts treated and furthermore assures therapeutic results equal and perhaps superior to the various adventurous methods now employed. The technic is simple, less time consuming and above all physiologic and constructive in its end results. The Dierker apparatus is the answer to the criticism resulting from ill effects and the ignorant procedures that have grown around this useful method of emptying the contents of an overburdened colon.

It goes without saying that any procedure that employs instrumentation and physical treatment carries with it a certain amount of psychic suggestion. For that matter, what part of our therapy does not? From the very beginning when a patient begins to think of professional consultation clear through every experience prior to and after treatment his psyche is an important element in his experience. The physician can take advantage of that fact and enhance his results or defeat it by improper consideration of this factor. And in the end, does it matter whether psycho- and physical therapy are combined for the good of the patient or whether either alone

create the hoped for results? I do not know how to divorce the patients ego from his physical part except by death, and for the latter state we have the mortician and the autopsy room. I always seek the highest cooperation (mental and physical) of my patients.

With regard to spasticity and to the question of Dr. Wiltsie concerning adhesions, strictures, and splenic flexures, there is no method in colon therapy that at present assures 100 per cent result. In spastic colitis, use of relatively warm water, about as warm as the patient can tolerate, will stimulate a dilatation effect long enough to clean it out. But if the spasticity is too great, or the flexure too sharp, the Schellberg tube will negotiate that curve better than any other method at our command. The method that I have described is not a panacea for every condition encountered, neither is any other method. I have merely attempted to introduce a more conservative approach and a more harmless irrigation of the colon.

As regards the reactivity of the colon to the gentle suction produced by the Dierker apparatus, the following experience may be of interest. After a thirty minute treatment to clean out a colon without suction, I introduced two inches of suction and in five minutes I obtained an extra pint of fecal matter that I did not expect was present. Thus by this extra technic one can clean out the colon beyond that with other methods.

As to the question about the case of appendicitis. The trauma associated with technics in which the height of the tank provokes undue hydraulic pressure is well known. Such treatments are liable to produce damage to the ileocecal valve and to the chronically diseased appendix. If one raises the tank no more than a foot from the colon, so that you are not exceeding four-tenths of a pound pressure, I can't see how one can do any damage. Never use any more than half a pound pressure to introduce the water, and never more than 2 inches of suction to empty it.

In answer to the question about my experience at Battle Creek, I left Battle Creek before Dr. Kellogg ever conceived of the idea of using colon therapy and electric therapy at the same time. Therefore, I can give you no information with regard to it. With the instrument described in my short paper one can insert the tube just as far as one wants. One can put negative pressure on the tube, if it is inserted six inches, a foot or three feet. It does not make any difference how far you insert the tube, the principle is just as effective for any distance.

Dr. Cutler: How about using hot and cold water to stimulate the bowels?

Dr. Worster: That would be effective but more hazardous than by the manner of controlled suction.

Dr. Voyles: Do you find a larger percentage spastic or a larger percentage atonic?

Dr. Worster: About 80 per cent of my patients are atonic, and about 20 per cent are spastic.

In conclusion I should like to reply to what the doctor said about arthritis. I wish to read you a letter that I received from a doctor in San Bernardino, California. He says: "My wife has arthritis. She has had her tonsils out. She has had her teeth out. She has had her appendix

out and her gall bladder. What shall we take out next?" I replied: "Nine-tenths of the large bowel—bring her over." She came and we treated her with colon irrigation. In three months from the day we started this patient was free of her arthritis. Such experiences are convincing evidence of the usefulness of conservative colonic irrigations.

PHYSICOCHEMICAL BASIS OF PHYSICAL THERAPY *

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Vitalism is now being revived by numerous biological authorities, although it was renounced about half a century ago. In former centuries the propounding of vitalism was chiefly the privilege of dialectic philosophy. In our days vitalism seems to be the result of experimental work by qualified biologists who limit their observations to living tissue. This tendency leads to the impression that the properties of living organisms are not paralleled to those of the inanimate world. Frequently we see that after collecting an impressive number of physical data on living organisms, some observers express their admiration for these supposedly wonderful properties. An attempt at duplicating them in artificial systems is not even considered, (or it is left to future investigators). Thus the final result is to supply new food for the vitalistic belief that life is unapproachable by artificial means.

A distinction between living and non-living phenomena, as it appears to exist according to such investigations, is largely the result of the manner of application of the science of physics. *It is not sufficiently realized that physical laws are, in many cases, summarized conclusions from observations on systems which are quite unsuitable for biological application.* The confusing influence of such an artificially enforced application can be found

too frequently in the literature: ions, electrons, electric charges of membranes, or of the pores in them, thermodynamic considerations, etc., are all used in attacks upon the secrets of life. There is no doubt that these and other concepts might be useful, but, it is necessary to know their exact meaning and to check their relations under conditions comparable to those existing in tissues. The only way to achieve this is, in most cases, the study of artificial systems which are well understood and controllable in every detail. By means of these a gradual approach to the more complicated condition *in vivo* can be attained.

I have attempted in a similar manner to describe in my book, "Physical Chemistry of Living Tissues and Life Processes,"⁽¹⁾ the situation regarding theoretical consideration in biology, particularly in respect to the application of physical and chemical laws. It seems that similar general considerations are also useful if it comes to a discussion of the physicochemical basis of physical therapy, such as the therapeutic effects of various notable x-rays.

One of the most interesting effects is that of mild radium or microcurie therapy. It has been shown that radium applications of 20 per cent or less of the erythema dose have a marked anti-phlogistic effect. Acting particularly during the stage of leucocytic infiltration, they have been found to be very helpful in boils, furuncles, cellulitis, soft tissue abscesses, and many other inflammations. Their action is explained as a result of the breaking apart of lymphocytes and polymorphonuclear leucocytes, which in turn set free immune bodies. It appears also that this

*Read at the Mid-Western Meeting of the American Congress of Physical Therapy, Indianapolis, March 13, 1934.

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low dosage increases the activity of the reticuloendothelial system and mobilizes the histogenous wandering cells. Moreover, mild radium radiation has a marked beneficial influence upon tissue repair, hence it was found very useful in chronic ulcers, pyorrhea, and similar conditions. A small dosage of radiation increases the red cell count and hemoglobin content in anemic states.

How can we account for these and other therapeutic and biological effects of radium? It has been suggested that radium has a direct electrical effect, in a manner comparable to a universal internal treatment by stimulating electrical currents, comparable to the aphorism that "life is an electrical mechanism." However, to be more specific, we ought to clearly define this electrical "action" or "mechanism." It may seem that one such possibility is found through the well known theory of selective ionic permeability and an explanation of the action of radium might be sought through its direct influence upon the charge of some membrane or possibly certain ions.

Theory of Selective Ion Permeability

It seems worth while, therefore, to discuss the theory of selective ion permeability somewhat more in detail. This theory — aiming at a definite concept about the mode of action of ions in living tissue — assumes the presence of semi-permeable membranes in tissue, permeable to one kind of ions, preferably the cations, and impermeable to the anions. The existence of such hypothetic membranes was first postulated by Ostwald (1890), as a means of explaining the origin of electric currents of tissues.

In the decades that followed, this notion acquired the status of a dogma in physiology, and was used as a kind of standard equipment more or less available for any suitable explanation, particularly so by R. Höber and his large school.

If there really is such a property as selective ionic permeability, then we should first demonstrate its presence in inorganic systems, in order to avoid the impression that vitalistic phrases are being used.

Numerous efforts have been undertaken, to prove the theory of selective ionic permeability but have given little evidence. The most notable attempt is that of L. Michaelis who claimed that a *film of perfectly dried collodion* has that long sought property of selective permeability. He has devoted a very great deal of work to this task.

Time does not permit of a complete descrip-

tion of all the details of Michaelis' work. The main arguments quoted by him in favor of the hypothesis of selective ionic permeability are the following. He observed that the electromotive force is generated by a system like:

+ dilute salt solution.	collodion film.	conc. salt — solution
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This is explained by him as the result of pores of molecular dimensions in the collodion film. These pores carry a negative electric charge, hence allow for the passage of positive ions, while the negative ions are held back — (a peculiar assumption, indeed! The opposite relationship would seem more plausible). Since the positive and negative ions move in the pores with a widely different rate of speed, they are supposed to give rise to electromotive forces just as those occurring between a concentrated and a dilute HCl solution when these are in direct contact (the H^+ and Cl^- ions always having a different speed). Thus the observed electromotive forces are explained by such a difference of ionic speed arising in the pores.

The fact is, however, that the same kind of electromotive forces is observed by using in the place of the collodion film, certain water immiscible liquids — such as cresol + fatty acid, etc. — *which cannot have any pores whatsoever*. The electromotive forces in this case are due to phase boundary potentials, as I have shown more than twenty years ago. A peculiar salt distribution, influenced by chemical reactions at the phase boundary occurs in this case. This leads to an accumulation of Na ions in the non-aqueous phase, independent of the concentration in the watery phases, and hence to phase boundary potentials which vary with the concentration of the bordering NaCl solution.

The conclusion would seem justified that *the collodion film electromotive forces* (arising from a difference of concentration of salt solutions in contact with the film) *are really phase boundary potentials, and not in any way related to differences of ionic mobility* (arising mysteriously in narrow pores). The proof of the correctness of this conclusion must be sought in the possibility that collodion is capable of chemical interactions, in the same manner as the water immiscible liquids, like cresol + fatty acid. The theory of phase boundary potentials demands that such a cresol + fatty acid, when shaken with aqueous NaCl solu-

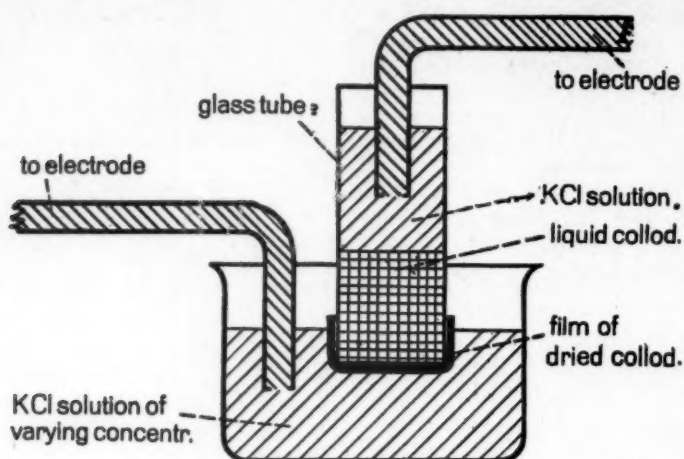


Fig. 1.

tion produces HCl, traceable by titration. This has been shown to be the case. The same should hold for collodion.

As has been quite recently shown in my laboratory, collodion does give rise to such a formation of HCl. This experimentally demonstrated formation of HCl from collodion + NaCl is in direct contradiction to the ideas of Michaelis who states:

Completely dried collodion is one of the very best electric insulators. When touched with wool or hair it becomes strongly electrified and will retain this charge over a long period. . . . (When such a membrane is thick enough and separates two electrolyte solutions, the conductivity is, at the beginning almost zero. It increases, however, rapidly with the progress of imbibition by the membrane.) *Now it would be absurd to suggest that water or a potassium chloride solution could go into "solid solution" in the dried collodion within some minutes. . . .*

Furthermore, this formation of an acid can be traced by unmistakable tests, the possibility of a salt error being completely excluded, since in another control the acid produced by collodion in the absence of salts is determined separately. This is invariably found to be much smaller.

Now if acid (HCl) is formed, the sodium must be bound by the collodion. There is thus a constant *Na ion concentration* in the collodion which does not vary if the concentration of NaCl in water is changed. This must produce such an electromotive effect of concentration as observed by Michaelis. (The amount of HCl formed is largely independent of the aqueous salt concentration, as can be shown.) A Na-collodion compound of constant concentration is present in the marginal

layers of the collodion. The collodion cell is in reality, therefore, a concentration cell in respect to Na ions; viz., it is really the following system:

— aqu. NaCl soln. conc.	Na collodion com- pound (constant Na conc.	aqu. NaCl + solution dilution
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Such a cell must produce an electromotive force as observed, in the direction indicated due to phase boundary potentials.

In the meantime, my collaborators and I found additional evidence to show that phase boundary potentials do exist at the collodion, as follows:

1. At my suggestion Dr. Loehr measured the cell arrangement:

liquid collodion ether and alcohol added	solid dried collodion	KCl of varying concentration
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Compare Fig. 1.

If the KCl concentration was changed the electromotive force varied in the same manner as on an ordinary dried collodion film, no matter which solution was first applied. This finding would be inconceivable according to the pore theory. The filling of the pores with KCl solution from opposite sides is manifestly obviated in this arrangement, hence no influence of the concentration upon the electromotive force of this system should appear according to the pore theory. This is never the case.

One may attempt to account for this discrepancy by the assumption that there are some pores left and that these are filled on the first contact with a given KCl solution which stays in the pores and comes into contact with the solutions subsequently applied. If this explanation were correct, the observed electromotive force ought

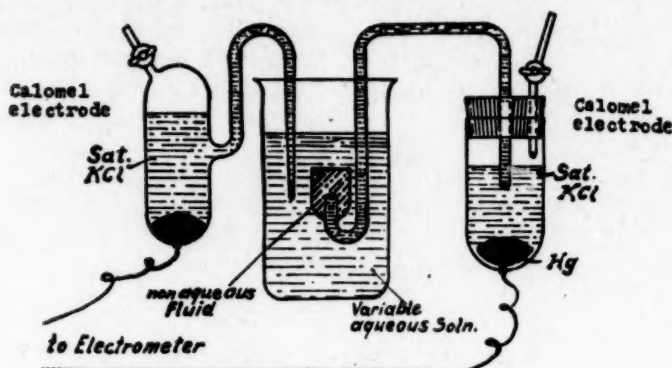


Fig. 2.

to depend on the concentration which was first applied. Experiments performed by my collaborators have shown that this is by no means the case.

2. Another argument contradicting the pore theory is found through the observations with mixed solutions. In my studies on phase boundary potentials twenty years ago, I saw that the electric potential of a mixture at a true phase boundary is not a middle value of the values of the two components, but is always nearer to the value of the more penetrating salt. The following experiments may serve to demonstrate this feature. An apparatus as shown in Fig. 2. was used; the cup attached to the hooked shaped electrode was filled with guaiacol, a water immiscible oily liquid, and immersed first in a dilute HCl solution (m/10). After connecting this solution by means of a calomel electrode to a measuring instrument — as indicated in the diagram — an electromotive force of 0.005 volt was measured, the negative pole being at the electrode on the left hand side in the diagram. If the beaker was filled with a dilute KCl solution an electromotive force of 0.020 volt in the opposite direction was observed. But, if a mixture of equal parts of these HCl and KCl solutions was used, the electromotive force was very nearly the same as with HCl alone, viz., 0.003 volt in the direction of HCl. Since HCl penetrates more than KCl into guaiacol, this experiment demonstrates quite conclusively the predominating influence of the penetrating electrolyte.

Similar observations have been recorded by using other water immiscible liquids as central conductor in the place of guaiacol, such as cresol, phenol, etc. In every instance the mixed solutions did not produce an electromotive force equaling the middle value of

the two pure solutions but a value was observed approximately the one of the more penetrating salt.

On the other hand, potential differences between miscible solutions ("diffusion potentials" as they are called) follow a different course; the potential of mixtures being nearer the middle value, or at least, not shifted extremely to the one side as in the case of phase boundary potentials. This was tested by using the same apparatus; the cup attached to hooked shaped tube being filled in this instance with concentrated HCl solution (molecular) held in place by means of gravel.

With dilute HCl in the beaker the
e.m.f. was — 0.034 volt
With dilute KCl in the beaker the
e.m.f. was + 0.050 volt
With a mixture 1:1, of these two the
e.m.f. was — 0.014 volt

It is noteworthy that in this instance the latter figure is near the middle value, being slightly shifted to the KCl value, very much in contrast to the variation of potential at a true phase boundary.

Due to this marked distinction, the question of the nature of the potential difference at a dried collodion film can definitely be answered. If Michaelis' theory is correct, the mixed solution should produce a potential near the middle value, since he pleads for diffusion potential in this case.

The observations show that this is not the case, the following results being observed:

With dilute HCl in contact with a
collodion film — 0.041 volt
With dilute KCl in contact with a
collodion film + 0.006 volt
With a mixture, 1:1, of these solutions
..... — 0.038 volt

These results, which were repeated and verified many times, leave no doubt that a true

phase boundary potential exists at the contact of collodion with aqueous solutions and not diffusion potentials as postulated by Michaelis.

Another argument quoted by Michaelis was based upon his finding of an inhibition of diffusion of a salt solution through a membrane, if water is on the other side of the membrane. For example, a salt such as KCl will diffuse through dried collodion if NaCl is on the other side, but not if there is water.

According to Michaelis this is explained simply as the result of the inability of the negative ion to pass. But this explanation fails to constitute as independent evidence, since the observed facts can be even better explained on the basis of the described chemical interaction between collodion and NaCl.

From all I have stated, it appears that the famous dried collodion membrane of Michaelis produces its electrical effects by dint of phase boundary potentials, or to put it in simpler words, electrical currents are being produced by its mere contact with aqueous salt solutions, in very much the same manner as a metal can produce electric currents in contact with salt solutions.

There may be pores in the collodion film, in fact, there is plenty of evidence to demonstrate their presence, but they are not the source of electric currents; all they can do is to interfere with the effectiveness of the existing currents by creating short circuits.

It seems therefore that the mysterious ionic sieve membrane is something postulated only for living tissue. It might be considered as something equally hypothetical as the "protoplasmic" or "vital" molecule invented by the vitalists who approached biology from organic chemistry, or to the "vital" atom which is introduced by the more modern vitalists, who base their ideas on what they learned about atomic physics. As I pointed out in my book it has always been the aim of physiology to apply to the fundamental biological problems the most discussed contemporary physical theory. Such a tendency—as I pointed out—has always been and is still now, the greatest damage to physiological research. Why should any up-to-date physical theory be applicable to those physiological problems which happen to be investigated within the same period of time?

Concerning the hypothesis of the "vital

atom," I want to refer to a much discussed book of Augusta Gaskell, "What Is Life?" This author assumes that the vital super atom is made by the Z. "Zoe" (or soul), as she calls it, and is created by intra-atomic changes in each instance, whenever a new organism starts to develop. Let me quote a statement from her book to illustrate the emotional background upon which she bases her ideas:

Human motherhood thus acquires a new and peculiar dignity with the beginning of the soul dating from the same moment as the beginning of the body of her unborn child, indeed holy, and akin to the brooding of tetragammaton* over a formless world, are the women's long days of enceinte waiting.

Perhaps I may mention also an English writer, H. A. Gray, who claims that the "vital atom" originated for the first time when the moon separated from the earth, due to peculiar cosmic changes of energy. Thus an explanation of the influences of the phases of the moon upon life phenomena is attempted.

All this shows us that the invention of vitalistic hypotheses is unlimited, and leads to impossible phantoms as soon as the basis of experimental facts is disregarded.

Effect of Biological Radium

Perhaps I have spent too much time on explaining what should not be done. The question must be answered as to what possible mode of explanation for biological radium effects would seem to be available. My suggestion would be to look upon these effects as results of photochemical reactions. We know of many instances where irradiation influences among other reactions also enzymatic reactions, viz., those reactions which are most important for life processes. I believe that the radiation emanating from radium is also capable of influencing enzymatic reactions, particularly those in which proteins are synthesized from peptones through the interference of oxidation. (Voegtlin, Rondoni), P. E. Haynes* performed some experiments on the digestion of boiled egg white using papain and acidulated pepsin as digestive agents. One of the test tubes with this digesting mixture was subjected to the action of mild radium, the other kept as a control. In several experiments of this kind, the digestion in the irradiated samples was found to be slightly more rapid than that in the controls. More

* Explained in a glossary to mean Jehovah.

* These observations have not been published so far.

experimental evidence of this kind is desirable, but these data seem to indicate that there is an effect of mild radium radiation upon enzymatic activity. It is in the direction of promoting digestion in these *in vitro* tests, but we ought to remember that the same enzymatic action may lead to protein synthesis in the presence of oxidation *in vivo*, as shown by Voegtlin, Rondoni, and others. This is due to the reversibility of enzymatic actions.

It may be objected to on the ground that the assumption of radium radiation (like other radiations) acting through photochemical actions, would seem to imply that electrical effects of some kind are connected with it. In

the ultimate analysis photochemical effects of any kind can be explained by some sort of shifting of electrons, hence they may be called electrical in character and the electrical explanation of radium effects which was condemned at the start is, after all, finally adopted.

To this I would reply that I have no intention of condemning in principle any explanation based on electrical actions. The point which I desired to emphasize as a matter of principle, was that every explanation should be based on experiments performed on simple non-living models. For this reason solely I object to the theory of selective ionic permeability.

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TREATMENT OF BAZIN'S DISEASE WITH MERCURY QUARTZ LAMPS *

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It is common knowledge that our therapeutic procedures have been constantly modified, discarded or completely revised according to the dictates of experience. This is particularly true in certain diseases of debatable etiology. In this group must be included Bazin's disease, and its difficulty of management. Of the methods advocated none has given outstanding satisfaction, and for this reason we report its successful treatment by ultraviolet radiation.

Bazin's disease, or erythema induratum, is defined by Sutton⁽¹⁾ as a chronic inflammatory disease of the skin, characterized by the development of ill defined indurated, symmetrical, subcutaneous nodules which terminate in absorption or necrosis.

Erythema induratum is probably tuberculous in nature. Leredde and Johnston classify Bazin's disease with the tuberculides, and Mantagazza — with the scrofulodermata. Whitfield maintains that there are two classes: One due to the action of the tubercle bacilli

usually occurring in patients below the age of forty, and the other, to any of several causes. Both types are clinically indistinguishable.

The disease seems to manifest itself from within outward. The morbid changes take place in the deeper layers of the skin and subcutaneous tissues. The nodules first develop in that region and are apparent only to the touch. They are felt usually as oval shaped indurated masses of the size of a pea to that of a dime, and are firmly adherent to the overlying structures. The more superficial layers of the skin become involved later, in the course of weeks or months, assuming then a reddish or purplish hue, hence designated as erythema induratum. The subcutaneous nodules are now of a firm consistency. They may later become doughy and eventually undergo necrosis (ulceration). When this occurs the discharge of the ulcers is often very profuse.

From the above description we can thus recognize two main stages in Bazin's disease:

1. Stage of induration.
2. Stage of ulceration.

Histologically the lesions are granulomatous

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* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 11, 1933.

in nature with many giant and plasma cells, the vessel walls exhibiting the characteristic features of inflammation.

Treatment and Technic

Bazin's disease belongs to that class of affections which is difficult to manage, especially in the ulcerative stage, "the severest type of the disease," when the patient becomes greatly alarmed and eagerly seeks medical aid. The methods of treatment at our command are either useless, troublesome to the patient, or both. The customary practice of scraping of the ulcers as recommended by some dermatologists, has been of little benefit. Roentgen treatment, tried by others, has had little influence on the ulcers. Sweitzer and Michelson⁽²⁾ failed to get any results from x-ray treatment (though they claimed good results with autogenous vaccine from these lesions). Rest and tuberculin injections seem to be of value, but cause much inconvenience to the patient. The individual is usually required to stay in bed, though he feels otherwise well, and suffers from the reactions of the tuberculin injections. The best treatment, according to our experience, is the use of ultraviolet radiation. When properly administered, the patient remains ambulant, has no pain, no systemic reactions, the ulcers healing without any inconvenience to the person.

Both the air cooled and water cooled mercury quartz lamps are used, the former for its systemic, the latter for its topical effect. We employed only suberythema doses.⁽³⁾ Strong erythema reactions are dangerous in these cases. It should be remembered that an excess of ultraviolet energy according to Bunker,⁽⁴⁾ kills the vitamin D in the skin after its formation. In the treatment, however, of small areas stronger exposures are permissible. We therefore gave such exposures from the air cooled mercury quartz lamp (in conjunction with general body radiation, daily, for one week) to the areas of the lesions, but this had no effect upon the latter. Since local treatments were imperative, we started to employ for this purpose water cooled irradiations from the Kromayer apparatus, the procedure being carried out in a different manner in the stage of induration than in that of ulceration, as indicated by the following case reports.

Case Reports

CASE 1.—Miss B., a Porto-Rican girl, age 20,

was referred to us from the skin clinic. She was rather poorly nourished. X-ray of the lungs revealed a healed tuberculous focus of the right upper lobe. She suffered from erythema induratum (and sarcoid of Boeck). The lesions were in the stage of induration and were situated mostly near the elbows on the flexor surfaces. A few were scattered here and there on the back and legs, the largest being at the middle of the extero-lateral surface of the lower left leg. We noticed livid spots of various sizes which on palpation one could feel the characteristic nodules.

Treatment consisted of general body irradiation from the air cooled mercury quartz lamp and local treatments to the lesions with the Kromayer apparatus. The window of the latter was applied with moderate pressure to each lesion, the skin around it being protected by adhesive tape. Time: from 15 to 30 seconds only. After the local skin reaction has totally subsided, another treatment, if required, was given to the same lesion. Two, seldom three, such treatments were sufficient for the cure of any induration. Some disappeared after one application. The treatments given were mild in order to avoid unnecessary severe reactions, such as pain and swelling encountered by Oliver⁽⁵⁾ when he used long applications with strong pressure. According to our experience there is much to be desired when treatment by "firm pressure for from one to two minutes to each indurated lesion" . . . produced such severe reactions that patients with Bazin's Disease "were in bed for two days after each treatment on account of pain and swelling." With the method advocated by us, not more than two lesions were treated at one sitting with the Kromayer lamp.

The indurations disappeared in about two months. The general body radiations were continued because of their definite beneficial effect on the sarcoid of Boeck from which the patient also suffered, as mentioned above.

CASE 2.**—Miss D., a young, healthy looking American girl, white, age 18, noticed November, 1931, a few livid spots which appeared symmetrically on the posterior and extero-lateral surfaces of both legs, about three inches above the ankle joints. These spots disappeared spontaneously. About ten months later they reappeared on the same places and broke down into ulcers which kept on increasing in size. She was treated by a private physician without any results. Eventually she came to the Mount Sinai Hospital and was referred to us.

When she was seen the first time in our clinic the profusely discharging ulcers were seven in number, ranging in size, from a quarter to that of a silver dollar, their depth being about $\frac{3}{4}$ of an inch. Another ulcer, the eighth, was in process of developing but reached only the size of a large pea. The progress was apparently stopped by the treatments which were given

* The writer considers it important to quote that none of Dr. Oliver's "patients had had ulcerations at any time, so that none" (of his) "cases were examples of the severest type of the disease" (ulcerative type).

** This case was presented by the author at the Mount Sinai Hospital Conference, April 28, 1933.

daily and consisted of general body radiations alternated by local exposures of the ulcers to the Kromayer apparatus. The technic for the latter was as follows: The healthy tissue was protected by a pad of gauze about 1/6 inch thick, which had a hole as large as the individual ulcer about to be treated. Through this hole the ulcer was irradiated in the following manner: First, by means of the Kromayer window which was screened with a blue filter and held within a distance of about 1/2 inch from the bottom of the ulcer. The time for each exposure varied from 1/2 minute at the start to that of two minutes toward the end. This was immediately followed by exposure of the ulcers to the rays from the unscreened window, using the same distance and the same time as with the filter.

The blue filter has certain advantages that require only brief descriptions. This filter is a screen made of quartz, which contains oxide of nickel and possesses a deep purple color. It excludes the destructive and far portion of the ultraviolet spectrum and only permits the near or biotic portion to be absorbed by the tissues. Thus only the mild or constructive rays of the ultraviolet spectrum are permitted by the filter to pass through. When the tissues are first radiated by these mild rays they are enabled to be then subjected, without detriment, to stronger radiations.

We believe that the rays passing through the blue filter possess a desiccating and stimulating effect, judging from their action upon the ulcers under our observation.

The profuse discharge of the ulcers was controlled in a week to ten days, approximately after four treatments with the Kromayer lamp. The ulcers were healed in nine weeks.

Summary

A number of cases of Bazin's disease in the indurative and ulcerative stages were treated in the Physical Therapy clinic of the Mount Sinai Hospital. The treatment consisted of the employment of quartz light from both the air cooled mercury quartz lamp and Kromayer apparatus. The former was used for general body radiation, the latter for the treatment of the topical lesions.

In the case of the indurations the treatment with the Kromayer apparatus was carried out by pressing its window against the lesions. In treating the ulcers no pressure against them was used. They were only radiated at a distance of about 1/2 inch from the Kromayer window: first, when the latter was screened with a blue filter and then, followed immediately, by irradiation from the unscreened window. The results were very satisfactory. Two cases are reported.

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Discussion

Dr. M. M. Lawrence (Jamestown, Ky.): Dr. Echtman has presented a clear description of Bazin's disease and its treatment. He has had exceptional opportunity to study this disease at Mt. Sinai hospital with its large clinical facilities. In the past twenty years I have seen and treated all varieties of dermatologic conditions both acute and chronic and this in a rather sparsely settled community of about twenty miles radius. In all this period I have only treated about five cases of erythema induratum (Bazin).

In 1926 one of these cases, a female, about fifteen years old was treated in a manner similar to that advocated by the essayist. She had a number of deeply placed purple-red ill defined nodules, which could be felt on passing the hand down the outer surface of the left leg. I saw her on passing her home and informed her that she had Bazin's disease. Several weeks later she came to the office exhibiting two sluggish ulcers. Her family history showed that her paternal uncle and grandfather died of tuberculosis. I treated her with the Kromayer lamp, shielding the healthy skin with adhesive tape up to within one-eighth inch of the ulcer. This patient also received several injections of tuberculin and general body radiations. Rest and cod liver oil were also prescribed. She made a recovery in about eight weeks, but retained two rather large scars and slight pigmentation. I saw this patient again in my office on August 7th, 1933, and closely examined her scars. They were respectively about an inch and one-half and three-fourths of an inch in size.

In the treatment of tuberculosis, tuberculides, or tuberculoid states, ultraviolet light is perhaps the sovereign remedy. I believe most authorities claim that the tubercle bacilli have not been found in Bazin's disease, although the guinea pig has on a few occasions been infected with the morbid tissue. Some authorities claim that tuberculides might be due to toxins derived from some distant tuberculous focus — named toxi-tuberculides. Others claim that a sudden discharge from the primary focus of bacilli into the blood stream becomes so modified as to reach the skin in a dead or attenuated condition. This theory will explain the occasional presence of acid fast bacilli in the local, dermal lesion. Another theory holds that the tuberculides are of the nature of allergic phenomena.

My records of the year 1927 show a couple of other cases which never reached the alarming stage of ulceration at least to any great extent, which when treated with the Kromayer lamp healed very promptly within six weeks. In these cases we used only antiseptics of hychlorite washes, Lassar's paste plus ultraviolet radiation, both of the Kromayer and the general body type.

While I have not handled the ultraviolet so scientifically by filtering and other restrictions as advocated by Dr. Echtman I have apparently cured recalcitrant cases of Bazin's disease as well as satisfactorily treating papulo-necrotic acne, and lichen scrofulosorum. The limitation of my experience permits me to say that in ultraviolet radiation, properly used, we possess a patent adjuvant for erythema induratum which should be more frequently applied when confronted with this difficult condition.

Dr. Maurice Dorne (Chicago): The results obtained by the essayist with the technic just described are most interesting. The affection classified as erythema induratum belongs to that group in which the tubercle bacillus unquestionably plays an important etiological rôle. This disease is very persistent, prone to relapses and recurrences, and very resistant to all forms of therapy, as compared to other types of the disease, occurring in older individuals, due to any one of several causes, but which are more amenable to treatment.

The report by Reyn of the Finsen Institute, a number of years ago, in which he demonstrated the curative results of Finsen light treatment in all forms of surgical and cutaneous tuberculosis, especially when local phototherapy is combined with systemic carbon-arc lamp irradiations, led to the use of ultraviolet irradiations with the air-cooled mercury quartz lamp and the Kromayer apparatus, either singly or combined, in all forms of cutaneous tuberculosis and this with varying results. There is sufficient evidence to justify the belief that ultraviolet radiation is a valuable remedy in certain types of cutaneous and subcutaneous tuberculosis. It is the opinion of some workers that the local application of ultra-

violet radiation in erythema induratum is of questionable value. Treatment of the primary or systemic tuberculosis is of paramount importance and such patients should receive general medical care with rest, light exercise, diet and general body irradiations as part of this regime.

I have employed this plan in my own service at the Mt. Sinai Hospital of Chicago, with gratifying results, but relapses were common in spite of the fact that the patients were hospitalized for periods of from three to six weeks. Patients with enfeebled peripheral circulation received treatments to the extremities with the electric bake oven in addition to the treatment mentioned. In the clinic, cases of the non-ulcerative type were treated with the Kromayer lamp according to the technic described by Oliver, and although the results at times were good, they were but temporary. I have not as yet had an opportunity to use the blue filter, but the results obtained by the essayist with his technic, the convenience afforded the patient in remaining ambulatory, the absence of unusually severe reactions and the factor of its safe use, undeniably bespeak a method worthy of a thorough trial.

Dr. Joseph Echtman (closing): With reference to the drying and shrinking effect following the application of the blue filter, I relate the following experience. In one of our cases the larger ulcer was the last to heal. When two-thirds of it was entirely healed, the remaining one-third was like the redundant tissue known as "proud flesh." I thought I could heal it with ordinary ultraviolet white light, but I failed and resorted to empirical methods. I attempted to check the condition with silver nitrate, but this made it worse and began to again discharge sero-purulent material. Hence, I again tried blue filter irradiation for two and a half minutes. The following day the diseased tissue was almost dry and the spot had become smaller, it had shrunk, and with a couple more treatments it was entirely healed. I wanted to close my discussion with this illustration, because in my opinion the blue filter has a drying and shrinking effect.



PHYSICAL THERAPEUTIC MEASURES IN SOUND CONDUCTION IMPAIRMENT *

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From time to time there have appeared carefully prepared reports regarding the value of physical therapy in the treatment of certain types of deafness. In many of these, the writers^(1, 2) have either expressed doubt as to the merit of these measures in any type or degree of deafness, or have expressed belief⁽³⁾ in its value in selected cases, and even in connection with an annoying tinnitus. Tinnitus too, in so far as relief by such treatment is concerned, has been placed by most authors, as improving or remaining uninfluenced, in almost exact proportion to the stated behavior of the hearing.⁽¹⁾

So pronounced is this diversity in the conclusions reached, that there must have been a difference in the type of cases treated, in the technic followed, or in the faithfulness exercised in treatments. It is a fair statement, that in half the cases seeking relief from faulty hearing, physical measures promise nothing, and if undertaken will prove sadly disappointing. It is, however, just as true that any and every other measure that might be undertaken in the same group, would prove equally disappointing. The reason for this sorrowful situation is, largely, that these sufferers, most of whom might have been benefitted at the proper time, make their first effort to obtain relief, only when their faulty hearing has become a serious handicap, or when their tinnitus has become distressing, at middle life, or well beyond.

Again let me say that physical measures should in no sense be made a substitute for the usual methods of treatment known to aurists everywhere. This applies to all cases and alike to surgical and medical means of relief. It is my conviction that no case of well established otosclerosis will be improved, nor have its progress much retarded, by any method of treatment now employed and that statistics showing, "no improvement" after diathermy treatment of otosclerosis, means nothing, either for or against this type of care.

Exactly the same is true of nerve deafness, and it is equally true in established calcareous or fibrous fixation of the stirrup.

Where there is, however, in early life, a pronounced tendency to catch cold, and more especially when followed generally by an observed faulty hearing, with or without tinnitus; where, in youth or in middle life, over a five or ten year period the hearing has slipped from normal, down to hearing a loud ticking watch on contact, or the spoken voice at ten feet and with the upper tone limits well retained, the lower tone limits relatively receding and with probably tinnitus more or less annoying; where, there has been comparatively recent suppurative otitis, with but partial recovery and definite advance in the hearing loss, with or without tinnitus present; where an annoying fullness or stuffiness in the ears, at any age follows each slight cold, rhinitis or pharyngitis; where through the years, the hearing recedes and very slowly recovers, after attacks of cold or influenza more or less severe; in fact, in practically all cases where otosclerosis is not present, where nerve deafness can be ruled out and where the foot plate of the stirrup is not definitely fixed, there is, I believe, reasonable hope of benefit resulting from treatments by diathermy, the sinusoidal or negative galvanic low-voltage currents and fairly deep pneumomassage.

Diagnosis and Early Treatment

Coates makes this significant statement,⁽⁴⁾ "There is little doubt that many, if not most cases of progressive deafness, that become manifest in adult life, have their inception in neglected Eustachian-tube and middle-ear inflammations, in infancy and childhood." And Fishbein uses these words "We now know that deafness commences in early life and even in childhood, although the loss of hearing may not be great enough to draw attention until middle age is reached."⁽⁵⁾ The fine work of Gundrum⁽⁶⁾ has particularly emphasized early diagnosis and early care, and he

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 13, 1933.

sums up his conclusions in the statement: "The prognosis of all deafness in children depends upon early recognition and prompt treatment." In commenting upon heat treatment in a series of cases of general sclerosis, Schmidt⁽⁷⁾ is confident that "cases which are treated early show the best results." Sclerosis is often a major factor in sound conduction impairment. These authorities are cited only to set out the very great importance of early, persistent and effective care in acute, subacute and mildly chronic middle ear inflammations. Much has been written about a lowered blood calcium in otosclerosis, but when treatment is directed toward its relief, improvement in developed cases is seldom observed. Every one knows that colds, inflammations and infections extend through the tubes, resulting in middle ear infection, or the deposit of inflammatory exudate in the tympanic cavity and an extensive hypervascularity with thickening and overloading of the cavity walls. In all these conditions early treatment offers the best results.

I believe that electrical influences, to be effective, must be delivered immediately to the pathological tissues involved in faulty hearing. While it is purely elementary, permit me to say that electrical currents pass most readily through certain types of tissue. They are not directional. To a degree, they will shunt around a bone like running water will shunt around an island. They are not concerned as to moving in straight lines or in hunting the shortest distance. Any resisting tissue or substance will divert a current around it and into a less impeded pathway, but, when forced through resisting tissue, of course, an added elevation in temperature is observed.

Politzer found glandular elements about the tympanic opening of the tube, and he names as many as six or seven "vascular mucous membrane folds" extending from the ossicles to the walls and from one tympanic wall to another, and besides these, a number of inconstant connective tissue prolongations, all of which are current conducting tissues. These, together with the mucous membrane covered ossicular chain and the heavy overloaded tympanic walls, form an ample current pathway. In discussing the middle ear circulation, Politzer⁽⁸⁾ quotes Prussak that in dogs, "The arteries often pass into the veins without the intervention of capillaries."^(8, 9) He

describes the veins, too, as being very tortuous and pouch-like, and further that the peculiar "relation of the tympanic mucous membrane to the osseous wall is of especial importance, inasmuch as inflammations of this membrane can produce transitory or permanent hyperemia and disturbances in the bone and the labyrinth." He makes the terse statement too, that "The seat of diseases of the middle ear is in its mucous lining." These statements evidence the very conditions wherein the stimulating, activating, metabolizing, absorbing influence of diathermy and the other modalities should function at their best.

In most series of cases that have been reported, there has been employed a smaller electrode over the mastoid and a larger contacting surface in front of the opposite ear. Hollander and Cottle⁽¹⁰⁾ developed this technic in a series of interesting experiments. They have reported a temperature elevation in the ear of the dog of two to three degrees with a d'Arsonval current of 400 to 500 ma. The question may be asked, is a maximum of benefit to be obtained from a temperature elevation of but two and a half degrees?

Degree of Temperature Elevation Attained

In discussing artificial pyrexia, Mendenhall⁽¹¹⁾ says "The main therapeutic effect aimed at is the production of a pyrexia to a hyperpyrexia point, i.e., 104 degrees and above that figure." And he emphasizes that a hyperpyrexia is the effect desired. Crile⁽¹²⁾ gives definite emphasis to temperature elevation and is credited with the statement that a 10 per cent increase in chemical activity and a two and a half per cent increase in the metabolism results from each advance of one degree in temperature. Kobak⁽¹³⁾ quotes van't Hoff as saying that "an increase of temperature of 10 degrees will double the velocity of reaction." And de Kraft⁽¹⁴⁾ states "It is necessary to measure the temperature and not the number of milliamperes."

These expressed opinions, together with those of many other workers, leave no doubt that temperature elevation toward the maximum readily endurable, is desired in this, as in other subacute or chronic, passive, exudative conditions. The statement appears to be literally true that "nature cures no disease, repairs no injuries, repulses no invading

organism, without the production of heat." Practically every day in my office, patients receive treatments wherein the temperature of

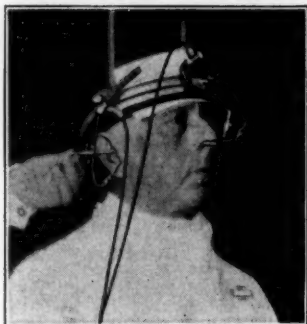


Fig. 1. — Two thermometers, one in the external meatus registering $108\frac{1}{2}$ degrees, the other with the bulb under the eustachian-orifice electrode registering 109 degrees, 150 ma. diathermy current. Current passing from one conducting cord split and applied one-half through electrode deep into each fluid filled external meatus; the other conducting cord, through broom shaped eustachian-orifice electrode, delivering one-half the amperage all about each eustachian-orifice. (Headband ear to ear switch closed.)

the middle ear structures, the Eustachian tube walls and almost certainly, much of the labyrinth and surrounding tissues are elevated to a temperature⁽¹⁵⁾ of 105 to 108 degrees F.

I have tied the bulb of a thermometer beneath the contacting surface of the broom shaped intranasal electrode and passed it along the nasal floor, well against the nasopharyngeal wall, so that the bulb rested beneath the broom shaped electrode against the membrane about the mouth of the Eustachian tube. At the same time, I have passed a thermometer bulb down past the cotton plug, beside the meatal electrode, into the current conducting fluid filling the external meatus. With the amperage of the d'Arsonval current raised to a comfortable tolerance, I have seen the mercury columns in the two thermometers rise steadily and in harmony up to 106, 107, $108\frac{1}{2}$ degrees F.

The surface of the external meatal walls added to the surface of the drum membrane totals just above a square inch. The contacting surface of the intranasal electrode as I use it is just a little less. Since then the entire walls of the fluid filled meatus, including the membrane, acts as one contacting surface and an equal area, all about the mouth of the Eustachian tube, serves as the contacting surface for the other electrode. Since these two surfaces are separated only by an inch and a half and are connected by muscle, connective tissue and mucous membrane lined

walls, and since the temperature at both electrodes taken many times, registers 105 to $108\frac{1}{2}$ degrees F. no one will doubt that a temperature but little below that figure prevails in the inch and a half pathway between these two contacts.

Either the sinusoidal current or the low voltage negative galvanic current is used for five minutes following 20 minutes of d'Arsonval treatment. As the sinusoidal current used at the close of the diathermy seance traverses the same path, it must produce a rhythmic contraction and relaxation of the muscles about the tube, the tensor tympanic and the stapedius. Benefit should accrue to these structures. The negative galvanic low voltage current is used because of its well-known effect upon the tissues. Hollender and Cottle,⁽¹⁰⁾ and Harris⁽¹⁶⁾ have a preference for this type of current. Fairly deep pneumomassage regularly follows the use of the currents, and expressions from patients are favorable. It has never appealed to me, to lightly dismiss massage with a wave of the hand, when careful observers have found it of merit. Patients find it more than satisfying.

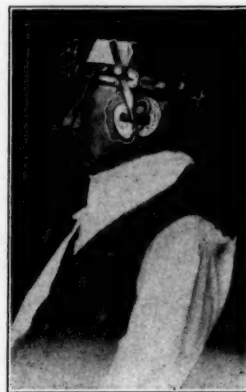


Fig. 2. — Three hundred to 500 ma. Diathermy current passing for eight minutes and large core of tissues including all ear structures, both ears in path of current; both extraural and meatal electrodes in circuit. Intranasal electrodes not connected.

Technic

In the technic which follows, the d'Arsonval current is from a heavy oil immersion transformer machine with an oscillation rate of probably above one and a half millions per second. It does not apply to the vacuum tube generators which utilize the condenser field and operate at five or 10 or 25 million oscillations per second, and which, according to Schliephake,⁽¹⁷⁾ and others, presumably exert

an additional influence, other than temperature alone. For several months I have used in my office a vacuum tube high frequency outfit, with an oscillation rate of 10 million per second, depending upon a balanced harmonizing or tuning of the current flow. Several patients believed it definitely superior, but the current application is essentially different, the

d'Arsonval circuit and from 300 to 500 ma. are passed through these ear to ear contacts alone for 10 minutes. The temperature in each external meatus will now stand at about 103 degrees F. The extra-aural electrodes are then removed, leaving the meatal electrodes still in position. The current from one d'Arsonval connecting cord is now split, one-

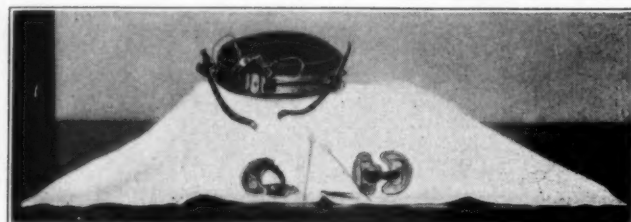


Fig. 3. Meatal extra aural and broom shaped eustachian orifice electrodes. Headband ear switch open.

electrodes are all insulated and the technic is out of place here. The average case showing improvement is treated every day for two weeks, then every second day for two weeks, then twice a week, once a week and finally once every two weeks.

The technic used for the past ten years has been modified. The extra-aural block tin electrodes are fitted snugly all about the auricles, behind covering the mastoid, in front pressing down the tragus, above and below. Each external meatus is filled with a current conducting solution, retained in the meatus by insertion of the meatal electrode, around the tip of which cotton is wound to a size that will just fit snugly into the meatus. The intranasal broom shaped electrodes are now passed into position. These intranasal electrodes are of small, smoothly covered, 12 or 15 strand conducting cord. The wires for an inch, at one end of the six inch section, are spread out into the exact shape of a broom. This broom shaped electrode is completely covered with a thin tuft of wet cotton and is inserted through the nares with little annoyance to the patient. They contact all about the mouth of the tube and against the naso-pharyngeal wall. This same principle was tried out by Hollender and Cottle and was used by the author several years ago. It was again revived by Yazujian⁽¹⁸⁾ and applied simultaneously to the two sides. The two extra-aural electrodes connected with the meatal electrodes, but not the intranasal, are now set into the

half going to each of the intranasal electrodes, which have now been switched into the circuit. The current from the other connecting cord is likewise split and delivered one-half to each of the meatal electrodes.

With this intranasal, meatal hookup, 100 to 200 ma. of diathermy current will pass before tolerance of the patient is reached. The temperature at each electrode will register 105 to 108 degrees and it is continued for 10 minutes. Any slight sensation of suspected dizziness will always be the signal to reduce the amperage. This is a safe index. It must always be remembered that, with the technic above described, one can produce a vertigo in any patient of any age. A vertigo so produced will pass in 20 minutes. Of course a vertigo should be avoided. But it is none the less interesting to note, that thus produced, this symptom is proof positive, that the influence being delivered, is registering its effect on the labyrinth. It would be impossible for the middle ear not to be influenced to the same degree. Galvanic currents too, of whatever type with the same contacts, would traverse the same pathway and their influence should register at their maximum.

Results however are the final test. Hollender in discussing this topic, recently said: "The technic applied may be wrong; all we can say is that the therapeutic test is the final test," and Dan McKenzie⁽³⁾ has said it has "so much diminished the deafness and tinnitus that I draw attention to the method in order that others may try it."

Conclusions

1. Physical therapy measures have proven definitely helpful in certain types of sound conduction impairment.

2. Much disappointment will be met unless cases are selected with care, and sometimes then, as not all selected cases are benefited.

3. Otosclerosis is never cured by these or other measures; it is possible, however, that symptoms may be retarded in early stages.

4. Stirrup fixation in any form will not be much influenced, nor will its results be modified.

5. Nerve involvement is never benefited.

6. Treatments to be helpful must be stimulating in type, and at first frequent.

7. D'Arsonvalization must climax definitely in the area of pathology and is not directional in the presence of intervening and more highly resisting structures.

8. Heat, in d'Arsonvalization of high oscillation frequency is probably not the only influence exerted.

9. Near the maximum of d'Arsonval current usable, over a 20 minute period, in improvable sound conduction impairment, is desired.

10. Negative galvanic, sinusoidal and pneumo-massage are probably valuable aids to treatment.

11. Fractional measures can not justify finality of adverse conclusions.

714 Equitable Bldg.

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RACHITIC DIATHESIS IN INFANT AND ADULT LIFE *

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The epochal publication by Huldschinsky, in 1917, on the relation of sunlight to rickets and the subsequent demonstration by Hess of the effect of sunlight on the activation of vitamin D have led to the recognition of this symptom-complex as a deficiency disease. In spite of the extensive research these discoveries provoked, there still remain a number of features about this type of nutritional disorder for which no satisfactory explanations have been advanced.

The first is that the precise manner or chemistry by which vitamin D exerts its control over calcium and phosphorus metabolism has escaped analysis. Through the brilliant work of Windaus, the identity of vitamin D has been properly established as an isotope of ergosterol. Spectroscopically, we can differentiate between activated and non-activated ergosterol. It is significant that this spectroscopic difference appears as a change in the absorption bands of that portion of the ultraviolet spectrum which alone is capable of transforming the molecular structure of oxygen into ozone.

Even with this isolation of vitamin D as a definite chemical entity, the limits of our knowledge of intermediate metabolism prevent us from explaining its rôle in mineral metabolism, just as we are equally at a loss to demonstrate the manner in which insulin controls the glycogenic function of the liver and muscles. We know it is necessary, and beyond that we know little of its metabolism. Because of this uncertainty concerning the mechanism by which vitamin D influences calcium fixation, the question remains open as to whether this effect is a direct and immediate consequence of the presence of vitamin D in the tissue fluids or whether it may be an indirect result of a chemical change of more fundamental and far-reaching importance.

Doubt of Vitamin D Specificity

Under the circumstances we may also assume that the specificity of vitamin D in preventing mineral deficiencies, or, at least, its

importance as a sole factor in such deficiencies, likewise, remains open to doubt.

In the literature on the subject of rickets, a great deal of emphasis is placed on the inorganic changes and the bony deformities, while the more profound derangements of metabolism, the growth impairment, the endocrine symptoms, the lowered resistance to infection, the digestive disturbances and the urinary changes are looked upon as of only secondary importance.

In support of the theory that vitamin D deficiency is not the sole factor in producing rickets, is the fact that rickets can not always be produced by a diet free from or poor in vitamin D. Moore⁽¹⁾ points out that there is a strong hereditary factor in the susceptibility of rats to rickets. The offspring from healthy rats will tolerate a deficient diet for a long period without developing rickets. The progeny of rats, however, that have had rickets will readily develop the disease when put on a deficiency diet. In their investigation of the relation of diet to dental caries, Agnew⁽²⁾ and coworkers also found that many rats failed to develop caries on a vitamin D deficiency if the phosphorus intake was adequate.

Clinically, we have observed that the children of mothers with rickety flat-foot or genu valgus are more likely to show similar deformities than those of normal mothers. On the other hand, we sometimes see rickets in children even when they have received a ration of codliver oil or viosterol from birth. Improper feeding and over-feeding may account for such cases to some extent, and we have greatly relieved the symptoms by correcting these factors. According to Chaney and Blunt⁽³⁾, the hydrogen ion content of the stomach largely controls the absorption of calcium and phosphorus. They refer to the experience of Zucker, Johnson and Barnett, who found that a diet favorable to the absorption of these elements could be changed to one producing rickets by the addition of alkali. They also state that Jones has successfully used HCL therapy in rickets.

Other conditions, too, have a bearing on

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calcium and phosphorus metabolism. Injection of pituitrin causes a marked increase in the blood phosphates while insulin decreases them. If the blood phosphorus is low, fasting will bring about an increase. The action of the parathyroid hormone on calcium fixation is so familiar that it needs little comment here. It was thought for a time that the effect of vitamin D on calcium metabolism might be explained as the result of some direct action on the parathyroid secretion. The present position in this matter may be summed up in the following quotation from Cantarow:⁽⁴⁾

The recent work of Hess, Weinstock, and Rivkin, and of Schelling further substantiates the view that viosterol is independent of the activity of the parathyroid glands. Their observations upon the hypercalcemic effect of irradiated ergosterol in thyro-parathyroidectomized animals has been reviewed in a previous chapter. It is evident, despite the fact that no definite conclusion can be drawn as to the normal relationship between vitamin D and parathyroid function, that large doses of viosterol can increase the serum calcium level in the absence of the parathyroids.

Because the blood serum has a much higher calcium content normally than can be accounted for as a simple ionic solution of inorganic salts or as protein combined calcium, it has been assumed that the principal function of parathormone is to act as a vehicle or carrier of this calcium.⁽⁵⁾

Influence of Endocrine Secretion

As has been recognized for many years, not only the parathyroids but all of the endocrine glands have a marked influence on the development and form of the skeletal system. Indeed, so close is this relationship that the nature of an endocrine disorder may be frequently identified by the characteristic changes in body stature. Perhaps the most obvious and common of these trophic abnormalities are those associated with thyroid deficiency.

It is not unusual to observe definite signs of cretinism, such as a large head, broadening of the face, asymmetry of the trunk and extremities, abnormal dentition, along with the symptoms attributed to rickets.⁽³⁾ The high calcium content of the thyroid gland as compared to that of other soft tissues, justifies the assumption that a close relationship exists between this organ and the utilization of calcium in the body.

Commenting on these observations Borchardt⁽⁶⁾ says:

It is not obvious that rachitic habitus takes

its origin from the endocrine glands, but the factors which cause rickets not infrequently do harm to the endocrine system. And, hence, the rachitic habitus is usually found associated with indications of inhibited growth, inadequate sex gland development, defective hirsutism of the axilla, and genitals, insufficient beard and hirsutism of the chest, which harp back to the same causes . . .

If we are to assume that all these profound disturbances of metabolism, growth, and the internal secretions, frequently to a degree that they not only result in serious injury to the individual but are transmitted to the offspring, have their origin in a mere dietary deficiency of vitamin D, then it must be shown that these disorders as well as the calcium deficiency are invariably prevented and corrected by vitamin D feeding. The mere production of rickets in susceptible rats by means of a deficiency diet does not establish that such a condition exists and can be clinically identified in man. On the contrary, it has been shown by several independent observers that rickets occurs in a large percentage of cases even when the diet contains a liberal allowance of cod liver oil. In a study of infants one to three months old, May Wilson found clinical evidence of rickets in 91 per cent although all of them received daily doses of one-half to one teaspoonful of biologically tested cod liver oil. In a roentgenological study of forty-seven infants receiving daily doses of one, two and three teaspoonfuls of biologically tested oil, 60 per cent developed rickets as compared to 76 per cent in a control series.

Clinical and experimental evidence points to the conclusion that in this syndrome characterized by calcium deficiency and impaired osteogenesis, there is a fundamental defect in the chemistry of protein synthesis by which normal cell growth and function proceeds. Is there a possible explanation of the nature of this disorder, an explanation that will apply to all the observed characteristics of the disease?

For a solution of this problem we call attention to the work of Koch⁽⁵⁾ on the parathyroid function. Koch was able to demonstrate and isolate a highly toxic substance in the urine of thyro-parathyroidectomized dogs. From this he deduced that the parathyroid secretion was an important reagent in the synthesis of cell protoplasm from the products of protein digestion. In the absence of this secretion

these proteidogenous compounds were extremely toxic and were not assimilable. The parathyroid hormone served to convert such toxic compounds into nutrient constituents of normal metabolism. Koch's discovery has been fully confirmed by the British physiologist, Bayliss.

It is conceivable that the calcium deficiency associated with parathyroid cachexia may be a part of a vicious cycle in the chemistry of the colloidal constituents of the blood and tissue fluids. In such toxic conditions, ultramicroscopy reveals a decrease in the size of the colloidal particles and increased dispersion. As a consequence of this physical change there is a decreased adsorption of electrolytes and a loss of electrical charge. This means a higher pH index of the substrate so that there is a shift of alkaline calcium phosphate to the soluble acid phosphate which is excreted in the urine. The diuresis and urinary findings of rickets are in accord with such a conception of the chemistry of the disease.

The objection to accepting a parathyroid deficiency as a cause of the toxic state of the blood and tissue proteins in rickets is the fact that parathyroid extracts are ineffectual in correcting the symptoms. The cause of the toxemia and the faulty protein chemistry must be looked for elsewhere.

Character of Cell Function

There is one simple, universal characteristic common to all living processes and all cell function — the property of the cell substance to enter into combination with free oxygen or its hydroxyl radical. The energy and rate of this chemical change is dependent upon four factors:

1. Temperature.
2. The availability of oxygen and oxygen tension in the circulating medium which is largely determined by the hemoglobin carrying capacity.
3. The presence and activity of certain ferments or oxidases as, for example, thyroxin.
4. The intramolecular, electrical state of the oxygen supply recognized as ionized, nascent, and trivalent forms.

To trace the intricate processes by which these energy transformations are brought about would be a long and difficult task and not germane to the purpose of this inquiry. The practical significance of the pernicious effects of suboxidation can be readily traced and

have been variously described in many disease states. The accumulation of electronegative ions and consequent acidosis due to the incomplete combustion of metabolites into their end products may not always be apparent, because of a compensating drawing on the alkali reserve, but the toxic symptoms nevertheless exist. An examination of these four factors determining the efficient utilization of oxygen, however, lies in the fact that modern studies in physical therapeutics have made it possible for the physician to bring to bear a number of effective measures on the regulation and control of all four factors. By means of hot baths, electric light cabinets, diathermy, radio-frequency, etc., the accelerating effect of high temperature on oxygen exchange can be made use of. Through scientifically regulated exercise and medical gymnastics, we can increase the blood circulation and correct any deficiency in the available supply of oxygen.

The more delicate and less noticeable physiochemical conditions given above under factors 3 and 4 are just as amenable to regulation through the powerful energizing effect of radiant energy particularly and specifically the Dorno ray band of ultraviolet energy in the frequencies of 2500 to 3150 Angstrom and otherwise spoken of as the antirachitic rays, or glass filterable ultraviolet. The direct energizing of the oxygen of the blood stream through exposure of the body surface to these rays, is not a theoretical assumption but has been demonstrated spectroscopically by Hofnagel.⁽⁷⁾ That this improved utilization of oxygen in the human and animal economy which follows such activation can be accomplished to some degree by feeding previously irradiated foodstuffs is not to be disputed. Such dietary measures, however, have no counterpart in the positive and often remarkable clinical improvement that follows ultraviolet ray treatment not only in rickets, but in a great variety of nutritional and metabolic disorders of adult life. Most of these clinical conditions in which ultraviolet treatment has proven to be indispensable, may be classed as manifestations of a general deficiency in the individual's chemistry, the thymolympathic or Graves' constitution, so classically described by Warthin.

It is doubtful, in view of the strongly fixed hereditary tendencies, whether such constitutional inferiority can be fully eliminated. To

substitute the feeding of nauseating fish-oils and their derivatives for the invigorating, kinetic rays of the sun in the attempt to overcome impairments is to invite defeat. Because of their alkalizing effect, the administration of large doses of calcium salts instead of improving calcium assimilation may actually produce the contrary effect. Six milligrams of calcium daily will maintain a normal calcium balance in a full grown healthy man. A pint of milk contains nearly 600 milligrams.

The popularization of sun-baths and outdoor life has done much toward correcting the deficiencies arising from sub-oxidation. Many of these infants and adults of lymphatic constitution need the additional stimulus of properly supervised ultraviolet radiation during the late winter and early spring months. To admit of any substitute or to leave such corrective measures to commercial interests is a serious injustice to ourselves as physical therapists and to the public weal.

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Discussion

Dr. Victor E. Levine (Omaha): Because we do not always see the thing in its entirety, we often make our mistakes in calcium, phosphorus, or sunlight therapy. To be more specific, rickets is a disease where many things are involved, especially the bone structure. In order to make bone structure, we have to have three things: the bricks, the bricklayer, and the factory. The bricks are the calcium and phosphorus, the bricklayer, vitamin D or ultraviolet, and the factory is some portion of the bone, the osseous tissue.

If you have any one of these factors missing you are not going to have the best results. Let me go back. There are many physicians who

give cod liver oil and they expect to build bone from cod liver oil, from the bricklayer without having any bricks. Here is another physician who gives calcium and phosphorus and gives a little cod liver oil, or none at all, or not enough, and he expects to find a child perfectly normal. That is why you find quite a few papers in the literature railing against the use of cod liver oil, because a certain physician has perhaps tried it on 86 children; has perhaps fed them cod liver oil, and then after taking an x-ray, he still finds the bone deformities which are characteristic of rickets.

Now, suppose the factory is not working correctly. How can that factory be spoiled? It can be spoiled through infection. Suppose I give cod liver oil and calcium and phosphorus to a child who has some focus of infection, either in the gastrointestinal tract or the respiratory tract. That infection demoralizes the bone forming factory. Hence the calcium and phosphorus and cod liver oil do not show up as the best therapeutic result.

There are other things that affect the factory and cause it to work with less efficiency. A defect in any of the glands, especially the thyroid gland, will immediately produce a marked disarrangement or marked derangement in bone formation. You can produce rickets in a good many children who are devoid of iodine. Suppose we take a child from a mother whose iodine is deficient during the period of pregnancy, or a child who has not received enough iodine for some reason or other, and give it therapeutically calcium, phosphorus and cod liver oil. The result in human experience cannot be the best. Why do we have so much better results in the laboratory? Because in the laboratory we can take every factor into account. We can regulate the whole experiment from beginning to end. With an infant we have an organism already formed and we cannot account for the past experience.

There is another factor to consider. Suppose you give calcium, phosphorus and cod liver oil to a child that has a congenital debility, a child that has been born markedly deficient in physical and physiological development. From our experience in the laboratory, if we take rats from mothers that have been more or less poorly nourished and kept in poor hygienic surroundings, we can produce rickets in them faster than among animals that come from better hygienic and dietetic surroundings.

Therefore, I would not say that cod liver oil is bad, nor would I say that calcium is bad, nor phosphorus. When cod liver oil first came into use, 150 years ago, it was not used because it contained vitamin A or D, because they knew nothing about vitamin A or D then. It came into use in medicine because of its large iodine content, and cod liver oil today is the greatest source of iodine for the infant and for the child, and iodine is just as important for proper development as calcium or phosphorus or vitamin D. Hence, I would not use ergosterol because it contains only vitamin D. Vit-

amin A is left out and the iodine disappears entirely.

Here again I mention the fact that we have in therapeutics a myopic state. We see the pathological point that is uppermost in our vision and we go right to it and prescribe. We see the tree but we forget the forest, and hence we cannot see the beauty of the whole situation, and we worry ourselves to death because our results are not as perfect as they could be if we were to take the whole situation into consideration.

Going back to our factory, suppose there is a child — and there are many, just as there are many adults — who has a low gastric acidity. The calcium and phosphorous are precipitated and pass out unused. There, again, your whole therapeutic procedure may be entirely lost. So whenever I have a chance to speak, even to our medical students at Creighton University, I always mention and stress the fact that we have to see the human being, not as an ear or a nose, nor as an individual who needs calcium or iron or cod liver oil, but before we give anything at all we have to see the whole situation, and when we do, it is interesting and therapeutically profitable.

Dr. G. J. Warnshuis (closing): The point that Dr. Levine has brought out in respect to the influence of infections on rachitic symptoms is well taken. I did not pretend that my paper would cover all the factors that can enter into producing the rachitic syndrome. My main purpose was to correct the impression that one gains from much of the literature on the subject of rickets, that it is purely and simply a vitamin D deficiency. I want to thank Dr. Levine for his kindly support of that position.

The reasons infections have an influence in producing these symptoms frequently lies in the fact that the toxic products of these infections are capable of bringing about much the same state of toxemia, the same decrease in colloidal dispersion, or as it is commonly spoken of as acidosis, that we have conditions of suboxidation, and that is a point that perhaps has some bearing on the question that was raised in Dr. Olsen's paper as to the relative influence of fresh air and ultraviolet radiation in bringing about the therapeutic response.

Naturally, fresh air will promote oxidation to a large degree, very much as ultraviolet radiation will. In fact, even before we knew anything about ultraviolet it was a well known fact that rickety cases were benefited by exposure to fresh air. I did not enter into a detailed description of cases that demonstrate the relative value of ultraviolet radiation as compared to vitamin D feeding, because I think most of you in your experience have had that thoroughly demonstrated. It is an old saying that familiarity breeds contempt, and just because we have come to learn what this wonderful life-giving, cell activating, energizing influence is in sunlight that brings about these curative effects, we are apt to slight its importance. It is our place because we do recognize the value of ultraviolet radiation, to take a determined stand against any of the interests that would lead the public to adopt substitutes that are inefficient, oftentimes useless, the introduction of which will deny the patient the remarkable benefit that he could get from ultraviolet radiation. We have heard a lot about the exploitation of ultraviolet, but we should hear a little bit more about its inadequate and insufficient use.

Possibility of Power Measurement in Short Wave

M. Poittevin at the March session of the Société Française d'Électrothérapie et de Radiologie, suggested the need for measuring the quantity of heat delivered to the patient during the course of treatment with short wave by means of the following formula:

$$Q = \frac{Wt}{J} \text{ in which}$$

Q, is the quantity of heat, in calories; W, the power, in watts; t, the time of application, in seconds; J, the mechanical equivalent of the calory (4:18).

There, it is important to measure the power to know this quantity of heat.

This measurement of power is possible with short-wave apparatus, the author recalling that this possibility had been pointed out by himself at the International Congress of Electricity, in 1932.

This need becomes the more apparent when it is realized that the milliamperemeter which is such a constant guide in diathermy and in even the lower frequencies does not offer any aid as regards the thermal sensation when radiathermy is employed.

The author described the method of measuring the power and the peculiar adjustment of the apparatus to make this method practical. He concluded by expressing the hope that physicians will measure the power in the course of applications, in order to permit comparisons between the results obtained.

OCCUPATIONAL THERAPY IN TRAUMATIC CONDITIONS *

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Occupational Therapy, an ancient art and a modern science, is just beginning to gain the recognition for which it has long struggled. Some one has written, "Occupational Therapy has been of sporadic growth — it has flourished at times in isolated places under energetic superintendents, has suffered serious setbacks, has been at all times incessantly harried and sniped at by indignant taxpayers and indigent politicians, and was transformed overnight by the exigencies of the war into an honored, if somewhat bewildered, guest at the doctor's table."

The individual not fully conversant with this discipline would probably define it as something that has to do with teaching patients how to make baskets. To many, occupational therapy is still regarded as a mild and harmless pastime to while away the hours of invalids — something that will do them no harm and may do them some good — but need not be taken very seriously. And yet, the foundation stone on which occupational therapy is built, its underlying principle, its reason for being, is as old as its civilization. As early as 2,000 B. C. the Egyptians used to take their mentally ill to the temple of Saturn where "pleasurable occupations" were given them as treatment. We later find a Greek doctor writing that "Employment is Nature's best physician. It is essential to human happiness." However, it is unnecessary to go any farther afield than a study of ourselves to know that this is so. A little introspection will make us realize how closely bound up our mind is with our body, how responsive one is to the other, how much of a whole we are. The peculiar and vital importance of occupational therapy is that its treatment is directed toward this whole. While it has definite therapeutic value for the physical ailment, it at the same time tends to re-

lieve any mental state which would retard recovery. More than this, it aims to keep alive an interest, to supply an outlet for creative self-expression, to encourage purposeful activity, to give something of the joy of living. Dr. Peter Bassoe of the Presbyterian Hospital, Chicago, has written, "Occupational Therapy prevents invalid reaction and promotes reconstruction better than any other therapy known. It aims to help the patient help himself, teaches self-reliance and strengthens the character by causing him to realize he has been the architect of his own reconstruction."

To go back for a moment to its definition and history, "Occupational Therapy is any occupation, mental or physical, definitely prescribed and guided for the purpose of hastening recovery from disease or injury." This includes music, recreation, craft work, any occupation used therapeutically. As regards its history, little mention is made of it through the Middle Ages, but at the beginning of the 19th century we find experiments being made in treatment by occupation for the mentally ill. In this field it now ranks second to no other type of treatment.

It was not until 1917, however, with our entry into the World War, that occupational therapy received its greatest impetus. Occupational therapists as Reconstruction Aides were called for in great numbers, and to supply this demand schools were started where short, intensive courses were given. These aides demonstrated so successfully the value of occupational therapy, not only in the mental field, but in the medical and surgical as well, that the schools were asked to continue after the war. The courses were lengthened and the standards raised, and occupational therapy from being confined almost entirely to mental hospitals, was successfully established in Tuberculosis Sanitaria and in general hospitals with medical, orthopedic, surgical, neurological, and cardiac types of cases. It has since

* Read before the New York State Physical Therapy Society, November 1, 1933.

been extended to Out-Patient Workshops and as an integral part of the Visiting Nurse Service.

Traumatic Conditions

The principle underlying occupational therapy in traumatic conditions is applied exercise. More than this, it is applied exercise made easier through the interest of the patient in the object of accomplishment rather than in the act of execution, thus removing mental inhibition. The interest of the patient is fundamental. A well known occupational therapist* has written: "If your elbow has just been removed from a cast and is stiff and painful, and the doctor tells you to bend it 50 times a day, you will either be faithful to his order and bend it with your attention entirely focused on the pain, or you will disregard his order and avoid going through the painful process. If, however, you are shown a lovely piece of fabric and are told that you may select your favorite colors and weave a piece like it, your desire to accomplish the task is aroused, you bend your elbow the required number of times in working on the loom and forget your disability in the absorbing task of creating something."

Everything we do, every recreation or occupation is made up of combinations of exercises. With the right application, these can meet almost any conditions of treatment. Each craft must be carefully analyzed to find out exactly what muscles and joints are used, also to find out how the method of work can be changed and adapted to suit other muscles and joints, also how the treatment can be graded from a small motion to a large, from light work to heavy.

Colles' Fracture

I want to illustrate several methods of treatment for Colles' fractures and fractures about the wrist. With these there is associated disability in all wrist motions, flexion extension, abduction, adduction and circumduction, forearm pronation and supination, and finger flexion, grasp and opposition. Active motion should be begun as early as possible for best results. It is necessary to begin with something very light, to give active motion with no resistance. We begin with a ball of wool, simple winding and unwinding. This requires some effort on the part of the finger flexors, and also gives a little active finger extension in raising each finger to allow the

wool to pass under. Later the ball of wool may be used for wrist circumduction, the motion being entirely with the lame hand which holds the ball, the well hand holding the wool and remaining motionless.

For the next step in treatment, we really begin to make something useful or artistic. It may be a woolen bag made on a simple board loom. It is very easy to do but may be made most interesting in combining colors in stripes or designs. The weaving is invaluable as a means of obtaining a variety of exercises, particularly in reeducation after nerve injury where we work for finger flexion from a position of wrist extension to that of wrist flexion, or for finger extension from a position of wrist flexion to that of wrist extension. These variations may be obtained in packing the weaving together with the fingers either in flexing or extending, the position of the wrist being controlled by the slant of the board. The handling of the wool gives opposition, and going over and under the warp threads gives pronation and supination. The process of pulling the wool may be varied so as to give wrist flexion, extension, abduction or adduction, the amount of resistance depending on the number of warp threads gone under before the pulling of the wool is begun.

One of the most valuable crafts we have for wrist fractures is block-printing, both because of the exercise it offers and because of the interest it holds for the patient. There is nothing which provides more creative joy than the making of handblocked Christmas cards, wall hangings and many other things. The design to be printed is cut on linoleum, which has been mounted on wooden blocks. These are inked by means of a printer's roller which is first rolled on the color and then rolled over the block, this process necessitating grasp and wrist flexion and extension. Next, the block is picked up (which necessitates supination and grasp), put face down on the material (pronation), and hammered in order to get a strong imprint. The hammer may be held so as to give either wrist abduction and adduction or flexion and extension, and it again requires grasp. The weight of the hammer is increased as the wrist grows stronger.

Woodwork

Before leaving the subject of craft work, I want to point out a few advantages of woodwork, a method which alone would be sufficient for treatment for most joint injury cases.

* Miss Marjorie Taylor, Director of the Junior League Curative Workshop, Milwaukee, Wis.

To continue with hands and wrists — all tool work gives grasp. If the grasp of the injured hand is not sufficient to hold the tool at first, the handle is built up to meet this requirement. The patient begins by sandpapering of a flat surface which permits grasp and very little wrist motion. He progresses to a sanding stick or file used on irregular edges. (To get wrist motion, the patient must be seated low, the upper arm close to the side, the elbow motionless. It is sometimes necessary to tie the upper arm in this position.) In rounding edges of an irregularly curved piece of wood we get much wrist motion. Filing over a circle is particularly good for wrist flexion and extension. Other tools giving wrist and finger exercise are the screw driver (supination), the hammer (flexion and extension or abduction and adduction), the drill (circumduction) and the coping saw which gives flexion and extension with a great deal of resistance. Woodwork may likewise be adapted to treatment for shoulder and elbow cases (through the use of sanding, sawing, planing, etc.) and for leg cases through the use of the bicycle and treadle saws, the treadle sanding machine and the foot-power lathe. These latter give motion to ankle, knee, and hip, which may be graded in degree and in the amount of resistance offered. In all treatments the patient must be made to do things in the right way to avoid compensation through the use of another joint. The position of the patient, the position of the work, the tools and materials used and the method of work all regulate the resulting exercise.

There are very many more crafts which are valuable as exercise and most interesting to the patient, among them basketry, loom weaving, wheel weaving, cord-knotting and metal work, but time does not permit discussion of their value.

This is not a theoretical discussion of what might be used. It has been and is being successfully demonstrated today in all parts of the country. At a rehabilitation clinic in

Los Angeles it was found that after the introduction of occupational therapy the time required for treatment was shortened 20 per cent.

In speaking of the combination of occupational and physical therapy, Miss Marjorie Taylor, director of the Junior League Curative Workshop, Milwaukee, where some of the most advanced work is being done today, writes: "The value in dollars and cents of occupational and physical therapy is shown by the amount the insurance companies put into this service. Our shop takes in an average of \$8,000 a year for insurance work and it is roughly estimated that about \$36,000 is spent yearly by the insurance companies of Wisconsin in the four curative workshops in that state We believe that our success is through the combination of physical and occupational therapy. We believe that functional restoration cannot be obtained so quickly without combining these treatments. The occupational therapist cannot prepare the injured part for activity and the physical therapist finds her greatest limitation in the psychological element. She can ask the patient to exercise, but she cannot provide incentive and interest great enough to make him exercise, and his attention during her treatment is focused on his disability."

Summary

The following, I think, is a splendid summary of the ideal occupational therapy holds for itself. Some one had said, "Rehabilitation may be termed as nothing more nor less than helping a derailed person to track again. In the derailment many things may have happened. Not only may we find the machine, the physical body, damaged, but the motive power, the spark, ambition, determination, persistency either run down or destroyed." And this is occupational therapy's own opportunity — while repairing the machine to rekindle the spark, this force without which the human engine stands motionless.

ULTRAVIOLET RAYS IN VINCENT'S STOMATITIS *

A. T. RASMUSSEN, D.D.S., F.A.S.S.

LA CROSSE, WISCONSIN

Probably no therapeutic agent or measure has been more misunderstood, misused and exploited than ultraviolet rays. Some over-enthusiastic individuals have made claims for it based on little more than a vivid imagination. Others, well meaning but lacking in the knowledge requisite to its intelligent use, can see no place for it in scientific therapy and have considered it on a par with fads and fallacies. Then there are the charlatans, the quacks, and that group of practitioners, who, while sailing under the colors of ethical practice, are primarily interested in the profits and monetary gains from its use.

The unwarranted mystery in the use of this intangible, invisible something called light rays has been and is being magnified by certain unscrupulous practitioners at the expense of its scientific possibilities. Consequently it behooves the conscientious practitioner to gain exact knowledge about ultraviolet therapy.

A voluminous literature exists on the etiology and treatment of Vincent's stomatitis. While there may be much about its morphology that is still unknown, research workers agree that the immediate cause of Vincent's stomatitis is a symbiosis of bacillus fusiformis and spirocheta Vincenti. In the interest of a descriptive nomenclature it would seem that this disease might better be spoken of as fuso-spirochetosis. This would also be more in accordance with the present day tendency to use scientifically descriptive terms rather than attach proper names to diseases or treatments. However, in this discussion we shall continue to speak of the condition under consideration as Vincent's stomatitis, in order to comply with the title published in the program.

Therapy of Vincent's Stomatitis

Many remedies and methods of treatment have been advocated. Some of them have merit, while others are without value. Few authors have anything to say about the systemic conditions acting as predisposing

causes, or the general systemic effects of fusospirillary infections.

I shall not dwell on diagnosis further than to emphasize the importance of careful differentiation,⁽¹⁾ and a warning against calling every sore or filthy mouth a case of Vincent's infection, or worse still, "trench mouth," a meaningless term that should be eliminated from our vocabulary.

The stomatologist, or dentist, if you please, sees more cases of Vincent's stomatitis than other specialists. Many are altogether too prone to limit themselves to local treatment, whereas a better understanding of cause and effect would lead to more intelligent handling of such cases.

In the practice of the healing art we cannot successfully work by rule of thumb as in the industrial arts. Doing so is responsible for many failures. Unless we have a clear conception of the cause and pathology of disease, we cannot properly decide on effective treatment. Likewise, without a definite knowledge of a selected method of treatment, we are in no position to apply it intelligently, so that it becomes a matter of chance whether the results will be good, bad, or indifferent.

Oxygen and Ultraviolet

The responsible organisms are anaerobic and light sensitive. Two rational methods of attack immediately suggest themselves. First, with oxygen, and second, with light rays. Ultraviolet rays of the shorter wave lengths especially, are highly cytotoxic and consequently lethal to micro-organisms of all kinds coming into optical contact. The time required to destroy them depends upon their resistance and the intensity of the rays.

Vorster quotes Browning and Russ, Goodman and Anderson, and von Recklinghausen in showing that the maximal bactericidal range lies between 2900 and 2300 A.u.⁽²⁾ Undoubtedly rays of a shorter wave length, even to the limits of transmission of quartz, or about 1800 A.u., are highly bactericidal when of sufficient intensity.

Therefore exposure of the affected parts to effective intensities of short rays, by means of

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 14, 1933.

suitable speculums or quartz applicators is a rational treatment that will materially reduce the number of organisms.

This germicidal effect of the rays is limited by their slight penetrating power, though Macht, Anderson and Bell find they penetrate much deeper than was formerly supposed.⁽³⁾ There is evidence that weak solutions of light sensitive dyes, such as a 1 to 20,000 solution of eosin, may be of assistance in increasing penetrability. Marked reduction in numbers of pathogenic organisms is of first importance.

The tissues must first be cleansed of mucus and debris of all kinds as thoroughly as possible, and hemorrhage controlled. This is not always easy as the affected structures bleed very readily and coagulation time is lengthened.

The best way to remove mucus, blood, and debris is to use a rather concentrated solution of hydrogen dioxide, (even up to full strength, depending upon its potency) sprayed onto all the parts and into all crevices, under heavy pressure. In addition to the cleansing effect the liberation of nascent oxygen in the presence of anaerobic micro-organisms will inhibit their growth.

Dosage

The structures are then carefully dried with soft cotton sponges and blasts of warm air under low pressure to avoid starting hemorrhages, and the parts irradiated, using a source rich in the shorter wave lengths, at a second or third degree erythema dose. The time of exposure depends on the efficiency of the generator, and on the voltage, amperage, and temperature at which it is operated.^{(1), (4)}

All statements concerning length of exposure, mean nothing unless qualified by the factors just mentioned. Each operator must know the efficiency of his particular combinations of generator and applicators under varying conditions of operation.⁽¹⁾ With any given generator, some of the exposures advocated in the literature would be utterly without noticeable effect, while others would be highly destructive in effect. Careful, intelligent thought is necessary in each case to determine the length of exposure for any given dose.

In addition to the bactericidal effect of the

treatment, the circulation of blood and lymph is increased in the parts, improving nutrition as well as speeding up the removal of accumulated toxins.

Painful and serious as the local lesions of acute Vincent's stomatitis are, and important as local treatment is, there is an equally, or more important aspect to this disease, viz., the systemic predisposing causes, and the general systemic effects.

Rarely, if ever, have I seen a viciously acute case of this disease that has not been complicated by general debility, acidosis, and other symptoms of hypo-vitaminosis. Frequently the patient has been under an unusual physical or mental strain. Often there is a history of sedentary habits or lack of outdoor exercise and sunshine; an inadequate diet; excessive use of alcohol or other narcotics; exposure to cold. Anything that tends to lower the vital forces may be a predisposing cause.

Improper mouth hygiene is frequently a contributing factor. Nature's effort to overcome the effects of inadequate hygiene is often a sufficient drain on the vital forces to lower the general body resistance. Pathogenic micro-organisms readily gain a foothold which in turn further weakens the system and slows up the metabolic processes.

Thus there is established a vicious circle, which if unbroken destroys not only local structures, but life itself.⁽⁵⁾

Blood Changes

Changes in blood chemistry in this disease, are marked by an abnormally long coagulation period, probably due to a lowered calcium content. Exposure of the skin to ultraviolet rays will shorten the coagulation time, due probably to an increase in calcium.⁽⁶⁾

Whether such results are the direct effect of the rays themselves upon the blood, or indirectly due to activation of some precursor of one or more vitamins, matters little as far as its clinical aspect is concerned. The important thing is the therapeutic effect of the rays.

Body irradiation is of value as a means of restoring a lowered alkaline balance to normal. Bonelly,⁽⁷⁾ and Davis⁽⁸⁾ and others, call attention to this. Clinical experience bears out their findings. As acidosis is one of the complications of fuso-spirochetosis, body ex-

posure to ultraviolet rays finds a place in its treatment.

The increase in numbers of red blood corpuscles and blood platelets and the greater oxygen carrying capacity of the erythrocytes following irradiation of the skin, as shown by Dorno and quoted by Warnshius,⁽⁹⁾ suggests it as a method of attack on the anaerobic organisms. No matter how deeply buried, or how secure from oxidation from the surface the organisms may be, they cannot escape the oxidizing power of blood well saturated with oxygen.

Sherry⁽⁶⁾ states that ultraviolet irradiation is useful in "secondary anemias, malnutrition . . . lowered resistance to infection, asthenia following acute infectious disease . . . It improves the general metabolism of the body, increases the phosphorous and calcium of the blood, stimulates the formation of blood platelets, increases the leukocytes and lymphocytes." It is readily seen from this that the general tonic effects may well be taken advantage of in treating debilitating disease.

According to Brooke⁽¹¹⁾ the red blood cells are increased in both quantity and quality. This indirect method of attacking infection is most effective.

Ultraviolet irradiation of the skin produces a definite increase in the white blood cells according to Sanford,⁽¹¹⁾ Sherry,⁽⁶⁾ and Furniss.⁽¹²⁾ The latter is authority for the statement that "even after one dose an increase of leukocytes amounting to from two to four thousand has been reported, the maximum being reached in about four to five hours after exposure."

Ultraviolet rays stimulate the leukocytes to increased phagocytic activity, which in turn causes an increase in the anti-bodies. Quoting further from Furniss, "it is the shorter ultraviolet rays that have the most important effect on the leukocytes."⁽¹²⁾

Despite all our efforts to destroy infecting organisms with germicides, we must depend on the vital forces of resistance to accomplish it, or at any rate to complete the task. It follows that it is rational to stimulate those forces to their greatest activity, and ultraviolet ray therapy lends itself well to this end.

Hypo-vitaminosis-Ultraviolet

The effects of the vitamins, especially A and D, following exposure of the skin to ultra-

violet rays has already been demonstrated. Whatever uncertainty there is as to the nature of vitamins, whether or not they are definite, chemical entities, or some form of electromagnetic energy, we know, to some extent at least, their effects, and these we get from ultraviolet. This is another reason for using this modality in treating such a debilitating disease as Vincent's stomatitis.

Osteonecrosis of the alveolar process is an early complication of this infection, while the overlying muco-periosteum and gum is more or less completely destroyed, depending upon the severity of the infection and the resistance of the patient. The osteomalacia beyond the area of necrotic bone is evidence that a rapid absorption of the calcium and phosphorous salts is taking place. Undoubtedly the entire skeletal structure suffers. Be that as it may, there actually exists a rachitis. Mineral metabolism is in a negative phase.

It is proper therefore to stimulate the metabolic processes, especially the mineral metabolism, to the end that the mineral elements be assimilated and "fixed" more rapidly than they are being withdrawn, so that healing may take place promptly and with as little loss of tissue as possible. Here again ultraviolet rays are an important means toward accomplishing that end.

In this connection, Mitchell and Coley⁽¹³⁾ have this to say: "The best antirachitic agent at hand today is a sufficient amount of direct sunlight . . . Ultraviolet rays are an entirely satisfactory substitute in the winter months."

Suggested Technic

Treatment should be continued until lesions are healed and normal physical conditions re-established. How long this will take depends, of course, on the severity of the case, complications, and the patient's response to treatment. The effects of disturbed metabolism are not overcome in a day, yet it is often gratifying to see how quickly nature responds to intelligent treatment.

Experience seems to teach that a fractional body treatment every other day, giving a first degree erythema dose is sufficient as a start. After the first few treatments they can be spaced a day further apart, and still later reduced to one a week. In severe cases I find it advisable to give a series of treatments, ten or twelve, two to three days apart, and then once a week for some time. At no time should

the dose exceed a first degree erythema. Tanning of the skin dictates a change to some other part of the body.

The local treatment of mouth lesions with the rays may advantageously be repeated as often as necessary to stimulate the tissues and for the other effects mentioned above. Resistance and degree of local erythema will largely govern. As soon as the disease is under control, as evidenced by the change of the lesions, etc., undue erythema should be avoided while smaller, tonic doses are beneficial.

It would seem needless to add that coupled with ultraviolet ray, or any other form of treatment attention should be paid to a suitable diet, proper elimination, etc. Of utmost importance to insure permanency of cure is the highly technical operation of curettage; elimination of pockets about the teeth, poorly constructed or finished dental restorations, care of carious cavities, etc.

All that has been said with reference to the value of ultraviolet ray therapy in the treatment of stomatitis can be said with equal emphasis concerning Vincent's angina of the throat.

While I would not be understood as advocating ultraviolet ray therapy as a panacea for Vincent's stomatitis, it has proven in my own and other hands a valuable method of treatment.

211-212 Linker Bldg.

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Discussion

Dr. R. J. Reade (Toronto, Can.): Dr. Rasmussen's presentation of ultraviolet rays in the treatment of Vincent's stomatitis is very conservative. He gives warning that harm is done by the over-enthusiastic individual, or the charlatan, by claims that have no scientific basis. But that is a drawback with which most new discoveries have to contend. No defense is required for the ultraviolet rays. Man did not make the ultraviolet rays. They are one of the forces of nature. Fortunate is man when he happily discovers their uses. That is our unremitting work and study.

Dr. Rasmussen contends that in all diseases general systemic conditions must be considered. He is on safe ground when he advocates the use of the ultraviolet rays direct from the sun, or from artificial sources.

There are two classes of necrotic gingivitis. One is due to mouth conditions that favor the growth of anaerobic organisms, for example uncleanliness, pyorrhea pockets, etc. The second is due to direct infection from external causes. For example infection from dishes, glasses, and eating utensils used by those suffering from an attack of Vincent's angina.

If the organism is virulent enough general treatment alone might not suffice. However, one would expect that the ultraviolet rays will be of great value for such general symptoms of the disease as malaise, increased temperature, increased pulse rate, insomnia, etc.

Dr. Rasmussen deals with the local application of the ultraviolet rays for their cytotoxic effect. This treatment should be efficacious if the organisms are not protected from the rays. Experiments should be able to demonstrate the merits of the ultraviolet rays in this application.

In all cases of this affection I have been able to produce analgesic results from the local application of the rays. I might add that in all cases of prophylactic scaling of the teeth the application of the actinic rays is soothing to the gums, and produces a feeling of well-being.

In the matter "intelligent dosage" I am quite in agreement with the doctor. He has emphasized the importance of a knowledge of the technic of

application. Without this knowledge the beneficial use of the rays is rendered doubtful, and perhaps harmful. I might add that the resistance of patients varies, which must be considered.

Dr. Rasmussen's remark on blood chemistry should be carefully noted, as it explains the beneficial effects of systemic treatment. The ultra-violet rays are in some way related to metabolic

processes which increase the resistance of the individual to bacterial invasion. After exposure to the rays there is found to be a marked increase in the number of platelets in the blood. The blood platelets are considered to be in some way related to the resistance of the body against infection. This supports Dr. Rasmussen's plea for systemic treatment.

TONIC EFFECTS OF COMBINED LIGHT AND AIR BATHS *

ALFRED B. OLSEN, M.D.

BATTLE CREEK, MICH.

It is passing strange that two of the most powerful healing forces in nature, light and air, have been forgotten, overlooked and completely neglected until comparatively recent years. In this instance the wisdom of the ancients surpassed that of modern men. Hippocrates, famous father of medicine, not only prescribed sun and air baths but built a solarium on the Island of Cos, for the practice of heliotherapy. Similar health institutions followed along the Eastern Mediterranean shores and the treatment became popular. Galen, the foremost physician of Rome, advocated sun baths. Many of the homes of the Romans were provided with solaria on the flat roofs for practicing the "cult of Apollo." These ancients appear to have recognized, to some degree at least, the remarkable hygienic and restorative virtues of light and fresh air.

Revival of Heliotherapy

During the past half century heliotherapy has been gradually revived until at the present time it is highly regarded by most progressive physicians. Today there are few first class health institutions and hospitals that do not have facilities for giving either the sun-air treatment out-of-doors or by artificial light. Among the modern pioneers of heliotherapy, mention must be made of Kellogg, who was one of the first to recognize and utilize this potent healing force. During his youth he suffered from double pulmonary tuberculosis and little hope was offered him by his family physician as to recovery. With failure of the or-

dinary medical regimen of the day he turned his attention to nature and the out-door life. With this and a generous non-flesh diet as taught by Sylvester Graham of Iowa, the leading dietitian of the day, he made a good recovery and decided to study medicine. After being placed in charge of the Battle Creek Sanitarium in 1876, he promptly made provision for sun and air treatment. Later on out-door gymnasiums were provided.

Another pioneer, whose attention was called to heliotherapy by an attack of pulmonary tuberculosis, was the late famous Dr. E. L. Trudeau of New York, who went to Saranac Lake in the Adirondacks, lived the out-door life and recovered his health. We can only barely mention the names of Finsen of Denmark, Bernhard and Rollier of Switzerland, and Gauvain of England, all of whom have done much to place heliotherapy on a sound, scientific foundation.

In more recent years much attention has been given by scientific investigators to the study of heliotherapy and its effects upon the body, both in health and disease. Everywhere it is being more used, both as a preventive and as a remedy. It is valuable as a means of fortifying the body against disease by strengthening the resistive forces of the body. This is particularly true of those who are inclined to anemia and physical debility. But it would be a mistake to regard heliotherapy as a panacea, even though it is a most valuable adjunct in the treatment of a very large number of diseases.

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 11, 1933.

Ultraviolet and Infrared Rays

It is well recognized that the main effects of the actinic rays are those produced by wavelengths varying from 2,900 to 3,000 A. U., with a maximal at 2,970, according to Hausser and Vahle. Wavelengths of 2,530 give only 16 per cent of the maximum, and those of 3,130 about $4\frac{1}{2}$ per cent of the maximum. But there are other almost equally important considerations such as the clearness of the sky and absence of mist, fog, dust and smoke. The red and the short infrared rays (7,000 to 9,000 A. U.) have the greatest power of penetration, passing through the wrist or forearm, according to Heald,⁽¹⁾ while the longer infrared rays (about 11,000 A. U.) have comparatively little penetration.

In a general way the chemical rays are most powerful and readily damage the skin by its so-called burning reaction. This destructive effect is very insidious, and much harm may be done without any warning because of the absence of heat sensation. Within a few hours there is intense itching and burning, and even blisters may develop if the exposure has been much overlong or too intense. The doctor should give explicit written directions to each patient. Blondes are more susceptible to burning than brunettes.

The unwarranted fear of cold and fresh air, irrational as it is, still persists in the minds of many people and seriously interferes with ventilation in the homes of most classes, especially in winter time. All need the fine, bracing influence of sunlight and fresh air. There is something comforting and refreshing about a sun-air bath when taken under favorable circumstances. But to obtain these health-giving effects it is necessary to expose the bare skin. There are few people that do not feel invigorated and benefited by such exposure. During the past century or longer, various physicians and surgeons have noted the striking healing effects of both sunlight and air when the bodies of the sick have been properly exposed. It was just such an observation that led Rollier to devote himself to heliotherapy. While it is true that artificial light provides rays equal to those of the sun, the fine tonic influence of the fresh air is lacking. Too often the radiation is given in close, ill-ventilated rooms, and the important stimulating influence is largely neutralized because of the lack of the bracing effects of the cold, fresh air. Out-of-doors exposure to

both light and fresh air is the ideal sun-bath as well as the ideal tonic.

Effects on the Skin

Covered with more or less heavy clothing twenty-four hours of the day, the skin becomes pale, anemic, inelastic and atrophied through disuse. It has to a large extent lost its natural functions of protection, elimination, and regulation of the body temperature. The reflexes are dulled and the skin becomes highly susceptible to changes of temperature, which often results in frequent colds, catarrh and bronchial infections, not to mention influenza and pneumonia. Nature designed the skin as a protection against changes in temperature, whether they are small or great, slow or rapid.

The combined air and light baths stimulate the skin and its glands, producing free perspiration, a healthy hyperemia and topical warmth, and increased firmness and strength. The pallor gives way to a healthy tan produced by increased pigmentation, the effect of the actinic rays. This pigmentation serves as a protection against rapid changes of temperature and also encourages the absorption of the light rays with a consequent general stimulating and bracing effect upon the internal organs. The layers of the epidermis are stimulated, causing the growth of new cells and thus improving the quality of the organ.

Exposure to light and air increases the circulation of the blood in the skin, bringing an extra supply to the surface, which relieves any congestion of the internal organs. The blood itself is enriched and elimination through the skin is stimulated. The vital organs of the body, which have been functioning in a weak and feeble state, are invigorated by the tonic effect of the sun-air bath. All the functions of the skin are improved and a good resistance is gradually built up by the daily exposure. One can scarcely exaggerate the splendid bracing and healing effects of such exposure to the skin and underlying tissues. But there are exceptions and the skin of certain persons is too sensitive to benefit by the exposure.

Effects on Respiration and Circulation

Respiration is immediately affected by exposure of the bare skin to light and air and especially to cold air. The breathing is easier and deeper and the lungs are more completely inflated by the fresh air.

According to Hill,⁽²⁾ the cool air aids res-

piration by contracting the mucous membranes of the nasal air passages, thus giving freer vent to the air. This prevents any sensation of "stuffiness" which causes such discomfort and even distress to those with a deflected septum. Deeper respiration means increased oxygenation of the blood, and a proportionally increased stimulation of all of the cells of the body. A scant supply of oxygen is promptly changed to an abundance of this life-giver, and the entire body is benefited by the enriched blood which is distributed to all of the tissues. Low metabolism is raised by the sun-air exposure. The circulation of the blood throughout the body is accelerated by the gentle tonic influence of the air-light exposure, for deeper breathing also means more perfect distribution of the blood.

Trophic Effect Upon the Muscles

Another remarkable result of sun-air baths is the genuine energizing effect upon the skeletal muscles. If anyone doubts this definite strengthening of the muscles all that is necessary is to watch the improved tone of the weak, flabby and semi-paralyzed muscles under the influence of the light-air treatment. Within a few weeks of such exposure, the muscles begin to show improved strength and vitality and that without any manual or mechanical massage or manipulations. It is not easy to explain how this increased muscle tone is produced. Some have suggested a chemical influence but nothing is definitely known. It may be due to stimulation of the nerve endings in the muscle underlying the skin by the shorter infrared and red rays.

One of the first effects of light-air exposure is improvement of a poor appetite. Those who, for various reasons, are suffering from anorexia and find it difficult to take food without a feeling of nausea, soon experience both an increased appetite and an improvement in digestion. The stomach benefits by the exposure and under its stimulating influence secretes gastric juice more freely and peristaltic action is enhanced. The improvement is not confined to the stomach but includes the small bowels and the colon. More than one patient has found this treatment a real aid in relieving an obstinate constipation. The tonic influence extends to the unstriped muscle of the alimentary canal as well as the voluntary muscles.

On visiting Rollier's world-renowned clinic

at Leysin, one cannot help but notice the sedentary life that the majority of these patients are obliged to lead on account of confinement to bed. Nevertheless, with rare exceptions, these patients enjoy good bowel movements. His explanation is the tonic influence of the daily light-air exposure.

Effects on Children and the Mental State

The special tonic action of light upon children is well illustrated by an experiment of Gauvain⁽³⁾. He says:

A ward was selected containing twenty children under the age of five, all suffering from active tuberculous disease of the spine, and all being immobilized and treated recumbently. Young children were chosen in order to exclude the factor of conscious suggestion. The children on one side of the ward had regular and systematic artificial light treatment for a period of six weeks in the middle of winter. In other ways, treatment, diet and environment factors of all the children were precisely the same. While the physique of those receiving light treatment showed improvement as compared with the others, the mental effects were even more marked. Those exposed to light were distinctly happier, more vivacious, more alert, and, I may add, more mischievous. They would often laugh and sing, and appear to be overflowing with animal spirits, while their fellows remained silent. They were notably more difficult to restrain. The contrast in appearance, spirits and mentality was most striking and was remarked on not only by those concerned with their care — the doctors, nurses and teachers — but also by casual visitors.

Gauvain gives the following interesting explanation of these beneficial effects upon mentality:

While the bodily improvement and the raised metabolism noted as the result of exposure to sun and open air, would of itself be likely to have an indirectly beneficial effect on mental activity, it is unlikely that this would be the full explanation of the increased mental activity which follows such exposure. In the study of the chemical changes in the blood following exposure to ultraviolet light, which have recently attracted the attention of so many investigators, it has been demonstrated that such exposure is followed by an increase in the blood phosphate. Is it not a reasonable hypothesis to present that, not only may bone repair be induced in the treatment of rickets by exposure to ultraviolet light, but other tissues may also be nourished and fortified? The suggestion is advanced, which further investigation may confirm or disprove, that ultraviolet light, shown to be an important factor in effecting tissue change, may thus improve the nutrition of the gray matter of the brain and in this way increase the output of mental activity. In the course of the physical improvement in rickets, a synchronous improvement in the mental condition and behavior of the patient is often strikingly manifest.

Sun-air baths have been utilized in a number of State Hospitals and with a varying degree of success. Cormac⁽⁴⁾ reports that mild cases of mental depression and melancholia are benefited by sun-air exposure, the period of depression being shortened. He also reports improvement in the treatment of delusional cases and confusional mental states and even in a few cases of dementia precox. It is generally agreed that many of these patients recognize a sense of comfort and exhilaration from the exposure, and also a tendency to cheerfulness. Darkness is naturally associated with depression and light with hope and good cheer. However, if the light baths are given in over-heated and stuffy rooms, much of the good effect is lost on account of the enervating influence of the close, hot air. Greater benefit will be secured by giving the treatment out-of-doors in the pure, clear, and cool atmosphere.

Psychoneurotic patients rarely fail to benefit by and enjoy sun-air baths and often regard them as the best treatment they receive, according to the experience of the writer. They welcome the out-door life, the gentle stimulating influence of the sunshine, and the cooling breeze as it plays over the body. There is a sense of both comfort and freedom amid the flowers, trees and birds that discourages worry and introspection. A spirit of hope and good cheer drives despondency away and hastens convalescence. Experience shows that with rare exceptions most of these patients benefit by the treatment.

A Specific for Rickets

It is unnecessary to call attention to the marked tonic effects of actinic rays in healing of rickets, which has been called a disease of darkness. Radiation of the skin by the direct sunlight or even by artificial light in well-ventilated rooms alone, is sufficient to strengthen the soft bones and restore health. Children even more than adults need the sunlight and the out-door fresh air in order to thrive and grow normally. If they are so situated that they can spend much of the day out-of-doors in the fresh air with the maximum exposure of the body possible, they do well, even though their diet may be restricted and unbalanced. It has also been shown that food deficient in vitamin D can be radiated by the actinic rays in the course of a few minutes, which will then supply the necessary

nutrition for the healthy growth of the bones. But this method of treating rickets is not recommended. Children should have a generous supply of food rich in vitamins and also the benefit of the out-door life with sun-air baths daily in summer time.

There are great numbers of people, both young and old, and especially those living in the large towns and cities, who are compelled to exist in a varying degree of anemia and physical debility. They lack vim, vigor and vitality, and their natural physical resources are materially reduced. Consequently they are only able to drag themselves to work in order to perform the daily task, and they find existence anything but pleasant and satisfying. Their daily life is hard and more or less distressing. Many, if not most of these people, would benefit greatly by getting acquainted with the sun and the fresh air. They usually over-clothe themselves and thus still further weaken vitality and dissipate their natural strength. Such people respond quickly to a course of sun-air baths out in the country, or in some small town or village where the air is clean and comparatively free from smoke and dust. This is the tonic that will do them the most good and the kind of vacation they require.

Danger of Improper Treatment

It must be remembered that light and air are potent tonics and capable of producing excellent beneficial effects when wisely applied or harm when improperly utilized. Light-air treatment must be given with intelligence and careful discrimination. There are a few people who do not benefit from exposure to sunlight or the actinic rays but suffer harm. They seem to be very exceptionally sensitive to light. In prescribing this treatment it is always necessary to give careful consideration to the age, complexion and general physical condition of each individual. The season of the year, the time of the day, and the presence of clouds, mist, fog, smoke, or dust in the atmosphere must be considered. Some people respond better by taking the treatment in the early morning or the late afternoon when the light rays are falling obliquely. If given during the heat of the day in mid-summer the applications must be brief to begin with, and only gradually increased day by day. It is not enough to say to a patient, take light-air baths. The only safe way is to give specific written

instructions. In many cases it is necessary to subject the patient to a careful physical examination before prescribing the treatment.

Summary

Combined sun-air baths may be regarded as among the best and most reliable of nature's tonics. It has been demonstrated by numerous scientific observers that controlled exposure of the bare skin stimulates not only all the functions of the skin but also of the entire body. Respiration is deepened and circulation is improved. Flabby muscles acquire firmness and strength. Appetite returns and digestion becomes more efficient with a material improvement in nutrition. Sun-air baths are a specific in rickets and are equally efficient in prevention or cure. The blood is enriched and low metabolism is raised. The splendid tonic effects of exposure to the sun and air has been demonstrated on children. They require sunshine and the out-door life in order to thrive and develop sound health of body and mind. Sun-air baths rarely fail to bring a refreshing comfort and a sense of well-being and ease.

172 Manchester Street.

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Discussion

Dr. Victor E. Levine (Omaha): Therapy has always followed two divergent paths. One path has led to the introduction into medicine of materials foreign to the human subject, such as drugs, x-ray, radium, lead, gold, arsenic, iron, and the like, in large quantities. The other path, which has always been eclipsed by the first path and which is now emerging from darkness, is the path leading to the use of agencies which are natural and known to the human being, such as those which we shall discuss at this convention: hydrotherapy, mechanotherapy, light therapy, heat therapy, dietotherapy, and other therapies of a similar nature.

Unfortunately, the new path is not yet completely paved. There are many things that we do not know yet scientifically about the subject, at least we do not know some of the fundamental facts. However, that should not prevent us from using these agencies because history tells us that all of the things we have used in medicine from

ages immemorial have been used because they were found empirically, not scientifically, to be useful. Later on when science develops, there comes the recognition of the fact that such an agency corresponds scientifically to what we should expect of correct therapy.

I mention again the fact that the agencies which we find along the second path are so simple that they are apt to be unbelievably or unused, and there are apt to be many misunderstandings and misconstructions. I simply have to mention the single fact that there are so many ignorant concepts regarding for example, the weather. We speak of a cold as if it were a very harmful thing. We speak of catching a cold. We still have the superstition of a draft, that a draft is something that will bring us into a pathological situation. Whatever we are not thoroughly acquainted with, we are afraid of, and when we get to know more about the tonic and beneficial effects of air we shall use it as God-given rather than be afraid of it.

We speak also of the weather conditions. Dr. Olsen has mentioned that in his paper. There are many people, I will say millions of people, who are below par physically, who are nervous, who are easily fatigued, who have no power of concentration, who lack vim and vigor. These people go to the physician, and the general physician does nothing for such an individual. We are so interested in textbook pathology and textbook syndromes that thousands of people who show symptoms that cannot be found on page 6 of Cecil's are not thought to be regarded as patients. It is this type of patient that is below par that is especially benefited by treatments such as Dr. Olsen has prescribed.

It is also necessary to know in connection with "under-the-weather" patients that many of them are slightly anemic, and it is astounding what poor notions the average physician has of anemia. Unless you have a hemoglobin of 75 per cent and a red cell count of 2,500,000, you are not anemic, and yet most of those people who have a hemoglobin content of about 75 or 80 and a red cell count of 3,700,000 or 4,000,000, or 4,500,000, are greatly benefited if you combine anti-anemic treatment with sunlight and air.

I also wish to mention the fact that it is very hard to differentiate the effect of one factor from another, because our knowledge is not yet complete. How much is due to the sun and what part of the sun is the beneficial factor in the tonicity which we find in reference to sunlight treatment? How much of this benefit is to be attributed to the air and what atmospheric factor is the one more or less responsible? Is it heat? Is it humidity? Is it the current of air? All of these things will be threshed out as we progress scientifically, but even if we haven't threshed them out yet, the clinical experience should have a good start and we should continue to use these remedies because clinically they have a beneficial effect.

Dr. Alfred B. Olsen (closing): Dr. Levine raised the question and put it almost word for word as I did to Dr. Rollier two years ago when

I was in Switzerland. I was there in the winter time because I wanted to see his work during the cold season. I inquired: "Doctor, you insist on putting your patients out of doors, in the fresh air, even if the sun isn't shining. Do you think just the exposure to the air, and what we might call the skyshine, is valuable?"

"Yes," he replied.

"You claim this marvelous massage effect upon the muscles is due to the exposure. How much

do you attribute to the air and how much do you attribute to the light, or the sunshine?"

"It is about half and half, in a general way," he explained.

Of course, you can't specify it absolutely, but I thought to myself from my own personal experience, that is about correct, and that exposure to fresh air, when the weather is favorable, is a good thing even though there isn't any direct sunshine.

PLACE OF PHYSICAL THERAPY IN ORGANIZATION OF A GENERAL HOSPITAL *

RICHARD KOVACS, M.D.

NEW YORK

Well informed members of the medical profession and well informed hospital administrators agree that a physical therapy department in a hospital contributes greatly to the welfare and comfort of patients and to the speeding up of their recovery. A physical therapy department, well directed, properly equipped and satisfactorily located, should form an integral part of every modern institution devoted to the sick or injured. Within the past fifteen years, principally upon the impetus of the favorable results obtained in the well-organized physical therapy departments in war and reconstruction hospitals, the number of physical therapy departments in general and special hospitals shows a remarkable increase. The 1931 hospital number of the American Medical Association reports 2,236 physical therapy departments in hospitals, compared with 4,523 x-ray departments. A survey of the hospitals of New York State in 1930 showed that 57 per cent possess a physical therapy department and that 34 per cent of the remainder planned to organize one. There can be no doubt therefore, that physical therapy has come to stay as a definite part of the organization of every hospital which wishes to render service in accordance with modern standards of treatment. There is also available abundant information about the operation of modern physical therapy departments, hence the pre-

sentation of the place of physical therapy in the organization of a general hospital is a fairly simple task.

The physical therapy department should be mainly a reference department, on equal status with that of the x-ray and of the laboratory departments. It must be under the direction of a physician especially trained in physical therapy, with a satisfactory background in general practice, and in active contact with all departments of the institution, thereby enabling the admission of patients under direct responsibility of the director in exceptional cases. The successful operation of the department depends on the following factors:

1. Proper direction, as outlined.
2. Proper personnel and equipment for the administration of treatments.
3. Easy accessibility to all parts of the institution.
4. Whole-hearted cooperation of the medical and nursing staff of the hospital. Physicians referring patients should be welcome to make suggestions as to the type of treatment, but final decision and responsibility must rest with the director of the physical therapy department.

When these requirements are lived up to the physical therapy department will be not only an asset in a remedial sense but usually will become one in a financial sense. Patients are pleased to pay according to their ability

* Read before the Fifth Congress of the Pan-American Medical Association, March 18, 1934.

for the comfort and restoration of function directly attributable to well planned and applied physical treatments.

Some of the obstacles still prevailing in the path of the proper relationship and appreciation of physical therapy in hospital work are as follows:

1. The appointment, as head of the physical therapy department, of a member of the hospital staff who may be a good radiologist or orthopedic surgeon, but who has never had comprehensive training along the broad field of physical therapy, which embraces service to all other departments of a hospital.

2. The granting by hospital authorities and by the medical staff of unwarranted authority to a nurse or technician placed in charge of a physical therapy department to prescribe treatments and be judge of their effectiveness. Such a policy often leads to improper evaluation of results and always brings about lack of broad service to the greatest possible number of suitable cases.

3. Refusal or lack of interest of members of the medical staff in referring proper cases at the proper time to the physical therapy department. Many a patient in the clinic, wards, or private rooms who could be effectively

benefited by definitely indicated physical measures never receives such treatment. On the other hand, it is an economic waste to insist that patients to whom physical therapy can be of no possible material benefit be treated in the department beyond a reasonable time. Patients should be referred with a complete diagnosis and all salient facts as to the case, and with some indication as to what is to be accomplished by physical therapy.

4. Over-enthusiasm, lack of tact, carelessness on the part of the director or personnel of the physical therapy department often serves as a handicap to the physical therapy department taking its full part in the work of the hospital.

The physical therapy department—the youngest and one of the most promising departments of a modern hospital—offers potential benefit to every other department in a well organized hospital or clinic. Its proper functioning and successful development depends, however, on the observation of the requirements stated, and, above all, on patient educational work on the part of its director and the mutual confidence and wholehearted cooperation of the entire hospital staff.

1100 Park Avenue.



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EDITORIALS

PHYSICIANS PENSIONS

We are living in an era of revolutionary rather than an evolutionary character. Values and standards which have been regarded as essentials of our social fabric have undergone considerable modification. The older concepts of organized society being divisible into rulers and ruled, have taken on an aspect differing in interpretation if not in principle. The general citizenship is no longer content to assert its sovereignty through the occasional opportunity to exercise its suffrage, but takes a daily, nay hourly interest in how far the government is carrying into effect the mandate of caring for the public weal.

One does not have to go far to look for the underlying cause or causes of the closer relationship between government and nation. Time was and to a lesser extent still is when election or appointment to public office, especially in states and communities, meant the acquisition of prerogatives without adequate service in return. What all perorations, preachments, pamphlets, and text-books on civics have for a long time past failed in attaining, the present economic situation has accomplished in a comparatively short period. And naturally so, because a full stomach causes laziness of thought and action, while hunger is an excellent prod to activity.

We are not here concerned with the pre-

war paternalism of foreign governments that brought about certain economic relations between physicians as a class and the bulk of patients; nor are we interested in the phenomena which made possible the appearance of autocracies, but we are vitally interested in more than 150,000 physicians who are barely eking out an existence in this our own great Republic. Nevertheless, it is not to be ignored that to a limited extent certain sociologic doctrines promulgated and practiced abroad have had an echo in our broad land. State Medicine to cite one example, is in the air. It has not yet come into being and probably will not come into being, at least not to an extent to effect the medical profession as a body, for there are as many with cogent reasons against such a scheme as there are who see in it the final solution of our problems.

There is no question that the present economic situation of the medical profession calls for immediate and permanent cure. Time was when the average conscientious practitioner of medicine received at least some compensation from his well situated clientele, so that he could live without financial worries, save a snug sum for a "rainy day", and carry sufficient insurance to protect his family against want after his death. Barring the comparatively few specialists of renown and the medical practitioners engaged in the public serv-

ices, the overwhelming majority of the profession can no longer look forward to such a future. With groups of unethical members of the profession running so-called cut-rate clinics on a commercial basis, with numerous charitable hospitals and dispensaries caring for anybody who applies, and with many private patients actually unable to pay for services or evading just payments under the pretext of the existing depression, the wonder is that not many more of our brothers in the vineyard have succumbed in one way or another.

Recently our President has taken the initiative with a view of ameliorating these impossible conditions effecting the medical profession. Advisory committees and enactment of legislation are the means to bring some succor to our down-pressed colleagues. Well and good if they succeed in attaining a concretely remedial measure. Details are still wanting, but even without knowing them we feel that temporary palliation only will be achieved, and that similar half-measures will not suffice definitely to solve our real problems.

It seems strange that the public services, which are notoriously less exacting in the required expenditure of brain and brawn, make adequate provisions for the well-being of their veterans while the nerve-racking and exhausting duties of physicians and surgeons who render services to the numbers of one and the same nation, are allowed to be terminated after many years without as much as a thank you. The policeman spending years at a street intersection directing traffic need not worry about his old age, because he knows that in due time he will be retired and pensioned. Is he entitled to better consideration than the man who say, for 40 or 50 years of his life has struggled to preserve the health in his community and to save countless fellow citizens from premature death? The physician engaged in practice in the Army, Navy, or Public Health Service admittedly has responsibilities not one whit different from those one encounters in civil practice, yet the government doctor on reaching the age of 64 receives two-thirds of his salary without being compelled to do any work not of his own choosing, while the civil practitioner at that age has still to worry about food, rent, clothing and other necessities for himself and his family.

Without entering into further details it is readily to be appreciated that even without state medicine or governmental supervision of medical practice, the average physician and surgeon will be able to render services to his clientele with an easier mind knowing that when he will be compelled by the inexorable results of wear and tear to lay down his scalpel or stethoscope he will have no worry for the remaining years of well-merited repose.

The state can certainly find the ways and means to enable every conscientious and ethical practitioner of medicine to have such assurance. And if the state does not feel the time ripe for such a step, our great American Medical Association can and should assume the task. Supposing this national body increases its membership fees by one dollar per year for the purpose just indicated, it would not only double its membership almost overnight but in the course of ten years have a large sum with which to bring well-being to such of its members who can no longer rely on their practice for the earning of a livelihood. This is more than a desideratum devoutly to be wished for, and the ARCHIVES will continue to agitate this matter from time to time until a definite scheme of pensions for old and disabled physicians will become an accomplished fact.

TRANSCEREBRAL IONIZATION OF BOURGUIGNON

The favorable effects of histamine and mecholyl iontophoresis for certain vasospastic and arthritic conditions have aroused new enthusiasm and hope in the increasing possibilities of drug transportation by electrolysis for other affections. That this hope will be realized is indicated by the published works of Bourguignon⁽¹⁾ in this field which merits serious consideration. His researches have been as brilliant as any of the labors to date, because they have demonstrated the practicability of electrolytic transportation of drugs through the cerebral vascular channels for that especially hopeless affection — the apoplectic state. The fact that medicinals have had little influence in this particular field of therapy, warrants a closer study of any information now available, especially when it emanates from highest scientific sources.

At a recent session of the French Society of Electrotherapy and Radiology, Professor Bourguignon⁽²⁾ summarized his laboratory and clinical studies of the effects of what he describes as transcerebral diaelectrolysis of various types of drugs. The term "diaelectrolysis" is one of his own coinage and is descriptive of its action, for which diaelectrolysis is perhaps a more concise description of its action in contrast with the term ionization as advocated by Brondel, in 1885.

In reviewing the action of the iodine ion as influenced by electrolysis Bourguignon pointed out its dual migratory properties—its transportation through the blood and its subsequent extraction from the circulation and fixation in the tissues by the current. As a corollary to this theory he advanced the hypothesis that one should be able to obtain the same results through the ingestion or injection of like solutions, which should also be influenced in a like manner by the passage of an electric current through the tissues. This indeed was verified by a study of 24 different drugs.

Of interest to the profession is the clinical implication of these observations. Having discovered while treating an hemiplegic individual that cerebral electrolysis could well be tolerated and that ionization could be more easily directed into the cerebral tissue by way of the orbito-occipital region, interesting reactions of clinical and physiologic significance were obtained. The passage of calcium ions into the encephalon caused an increase of the oscillographic index of the arm on the side opposite to the affected hemisphere. Use was made of this observation to systematically study the action of different ions and their influence on the vaso-motor cerebral centers on both normal and hemiplegic individuals. As a result of this work a new orientation is developing for the care of postplegic conditions which promises a more hopeful prognosis as well as a more selective method for their treatment. With the increasing clinical application of electroiontophoresis it is hoped that its therapeutic frontiers will be extended in many directions, the work of Bourguignon being but an index of its future trend in medicine.

References

1. Bourguignon, Georges: Traitement de l'Hémiplégie Cérébrale Traumatique par le courant Galvanique avec ionization de chlorure de calcium, *Extrait de la Rev. Neurologique* No. 2, Feb., 1922.

2. — Extrait du Bulletin officiel de la Société Française d'Electrothérapie et de Radiologie Médicale, March, 1934.

ARTIFICIAL FEVER THERAPY

The limitations for the use of artificial fever therapy are becoming more clearly defined. A recent report of Simpson¹ is based on the use of Kettering hypertherm, a simple air conditioned cabinet with which it is possible to elevate the patient's temperature rapidly and to maintain it at the desired level for an extended period. The use of this form of hyperpyrexia has been largely concentrated on syphilis: One hundred and seventeen syphilitic patients were treated, and in 87 the course was completed. The best results were obtained by combining antisyphilitic therapy (e. g., bismuth compounds, iodobismutol or tryparsamide) with at least 50 hours of sustained fever at approximately 106 degrees F. The sessions of fever were usually given weekly for ten weeks, with five hours of sustained fever at each session. The antisyphilitic drug was injected half an hour before each session of fever. After completion of this program the patients were given a follow-up course of antisyphilitic chemotherapy at weekly intervals for twenty weeks.

Of 16 patients with dementia paralytica, 12 obtained complete clinical remission, two improved markedly and were restored to a working status, one showed moderate improvement, and one was unimproved. The spinal fluid Wassermann and Kahn reactions were reversed to negative in six instances, became less strongly positive in six and remained positive in three. The blood Wassermann and Kahn reactions were reversed to negative in eight, became less positive in three and remained positive in four. There were seven patients in the taboparetic group. Improvement in mental orientation occurred in six. Subsidence of root pains occurred in all, but two patients experienced recurrence of pain, which was controlled by additional treatment. In four of the five patients with ataxia, the gait improved. The spinal fluid Wassermann and Kahn reactions were reversed to negative in two instances, became less strongly positive in one and remained positive in four. The blood Wassermann and Kahn reactions were reversed to negative in one, became less positive in one, remained positive in two, remained negative in three and became more strongly positive in one. One patient in this series had a syphilitic neuroretinitis, which responded promptly to the treatment.

Of nine patients with tabes dorsalis, ataxia was a prominent symptom in eight; two were restored to a normal gait, two showed 50 per cent improvement, two showed 75 per cent improvement and two were not improved. Root pains were abolished in all. In one patient the symptoms of cord bladder disappeared. The spinal fluid reactions were reversed to negative in two, became less strongly positive in three and re-

1. Simpson, W. M.: Artificial Fever Therapy, *Proc. Staff Meet., Mayo Clin.* 9:567 (Sept. 19) 1934.

maintained positive in four instances. In a group of 10 patients with diffuse central nervous system syphilis with eye symptoms predominating, favorable results were promptly obtained in six with interstitial keratitis, two with choroiditis, one with neuroretinitis and one with iritis. In six patients with asymptomatic neurosyphilis, the spinal fluid Wassermann and Kahn reactions of all were reversed to negative. There were six so-called blood Wassermann-fast cases. The serologic reactions were reversed to negative in three, became less strongly positive in two and remained positive in one.

Simpson reports some studies on the use of this treatment in early syphilis and in arthritis. He believes that in early syphilis the results are often favorable, though there has been insufficient observation from which to draw conclusions. The problem in arthritis appears to be one of selection of the proper type of patients. In the hands of unskilled workers, he believes, the possibility of doing harm with this form of therapy is perhaps greater than that of doing good. Its use should therefore be confined for the present to those having an intimate knowledge of the subject. — Editorial: *J. A. M. A.* 103:1581 (Nov. 3) 1934.

THE ARCHIVES AS A SUITABLE CHRISTMAS GIFT

At the last annual meeting in Philadelphia it was suggested that members could help increase the circulation of the ARCHIVES by giving this valuable monthly medical periodical as a gift to a colleague. As the time is drawing near to the holiday season, this subject is presented sufficiently early to remind those who favored the suggestion when it was made. It is, we believe, unnecessary to point out the merits of the ARCHIVES, which today occupies an enviable position in its special field.

If you are thinking of remembering your associate, your assistant or your hospital library with a holiday offering, do so with a subscription to the ARCHIVES. Send in your

check for \$5.00 the annual subscription price with the name and address of the one who is to be the recipient of your gift. A suitable acknowledgment will be made and the new subscriber will receive the ARCHIVES starting with the new year.

It is sincerely hoped that the members of the Congress will act on the suggestion, and that as a result, a large list of new readers will be added to its official journal.

KRUSEN APPOINTED MEMBER OF COUNCIL ON PHYSICAL THER- APY OF THE AMERICAN MEDICAL ASSOCIATION

The addition of Dr. Frank Krusen to the Council on Physical Therapy of the American Medical Association meets with general approval of all who are acquainted with his sterling labors in behalf of scientific physical medicine. Since his graduation from Jefferson Medical College in 1921, he has been an active member of the medical profession. He has served in many honorary capacities during this period, having been associated in all progressive programs within and outside of Philadelphia, his home. He has served on many important committees both local and national, is at present connected with Temple University in the capacity of assistant dean of the Medical School and as director in charge of the Physical Therapy department. Dr. Krusen is the author of many articles related to physical therapy practice and the author of a book on light therapy. He is also the Chairman of the Committee on Graduate Education of the Council on Physical Therapy of the American Medical Association, Chairman of the Committee on Physical Therapy of the Pennsylvania State Medical Society, Associate Editor of the *Pennsylvania State Medical Journal*, and on the Editorial Board of the *Archives of Physical Therapy, X-Ray, Radium*. In his relatively short period of practice Dr. Krusen has managed to attain an enviable reputation in his community because of personal and intellectual charm. His friends wish him warmest felicitations.

SCIENCE, NEWS, COMMENTS

Nobel Prizeman Simplifies Liver Treatment of Anemia

A more effective, more convenient and cheaper liver extract for controlling pernicious anemia is the latest achievement of Dr. William P. Murphy, one of the trio of American scientists whose conquest of this disease was crowned by the Nobel medical prize announced last week.

Instead of a patient's eating a quarter to half pound of liver daily or swallowing three doses of the older less concentrated liver extract, the new liver extract is injected in a muscle only once monthly.

Developed at Peter Bent Brigham Hospital, Boston, with the cooperation of Dr. Guy W. Clark of the Lederle Laboratories, the new concentrated extract for intramuscular injection is expected to reduce the difficulties and expense of treating unfortunate victims of this disease. Dr. Murphy made known the possibilities of the new extract in responding to a Science Service request for comment on his latest work.

The average pernicious anemia patient to keep well must:

Eat 11 pounds of liver during each month, costing about \$5.50, or

Take by mouth a potent liver extract, three vials daily, or 84 doses during each month, costing approximately \$17.00, or

If the new Murphy-Clark extract is used, one shot into a muscle once monthly, the extract costing only \$1.20.

The death rate from pernicious anemia are ages 30 to 50 years has been only half so great since liver treatment came into use, Dr. Murphy explained. He predicted further reductions and that there need be no deaths if patients cooperate. — *Science News Letter*, November 3, 1934.

The Physical Bases of Short Wave Therapy.

Four weeks ago the Biophysikalische Gesellschaft für Kurzwellenforschung was founded in Vienna, and just recently Prof. Dr. Paetzold of Erlangen delivered at its first session an address on "The Physical Basis of Short Wave Therapy." Paetzold explained that short waves effect a warming of the electrolytes; that is, the solutions of crystal salts, which are present in the body in large quantities and in various forms. Paetzold found that, with a definite resistance and a definite constant in an organism, the maximal heating of the organism (of the electrolyte) is brought about only by a certain wavelength. In general, this maximum is brought about in body fluids by waves from 3 to 15 meters in length. These waves are called "ultrashort" waves. They have an advantage over the short

and long waves in that they produce geometrically straight rays, which can be precisely controlled and given any desired direction. They can easily penetrate otherwise poor conductors, so that overheating or burning of the skin is impossible. The easy penetration of the waves makes possible also a particular effect on the deeper tissues. In the transmission of electric heat energy, the skin, fatty tissues and bones receive less heat than the parts and organs of the body containing large amounts of fluids. Also the problem of selective heating was hereby solved, and the temperature differences between the various layers can be exactly determined. The advantages of the ultrashort waves permit their use especially in rapidly developing inflammatory processes, which is just the opposite of the use of diathermy. — Sec. on Foreign Letters, *J. A. M. A.*, 102:1243, (April 14), 1934.

Fight Malaria by Treating People Instead of Insects

By controlling the human element instead of the mosquito, the number of persons afflicted with malaria has been reduced in several Panama towns from 62 out of a 100 to only 8 out of 100.

This is the accomplishment of the past five years reported to the Gorgas Memorial Institute's board of directors by Dr. Herbert C. Clark, director of the institute's Panama laboratory.

Mosquito control by screening buildings and draining and oiling swamps and other breeding places of the malaria-carrying mosquito is the ideal method of fighting the disease, Dr. Clark emphasized. But it is very expensive and not suited to conditions in labor camps in the tropics.

So he and his associates have worked out an alternative method which consists in giving malaria treatment to all carriers of the disease as well as to persons actually sick with it. By thus eliminating the malaria parasite from the blood of persons living in tropical camps, the scientists can prevent the mosquito from picking it up and carrying it to a healthy person in the camp.

Atabrine is the medicine used in this work not because it is any better than quinine but because it is preferred by the people who have to take it.

Business firms can afford this method. — *Science News Letter*, October 27, 1934.

Annual Meeting of Academy of Physical Medicine

This year's meeting of the American Academy of Physical Medicine marks the twelfth annual session of this organization. The two days devoted to its scientific transactions attempted to review the newer innovations and concepts of physical medicine as well as some of the perma-

ment and stable advances of past years. On Tuesday the scientific session was opened with a Presidential Address by William L. Clark, and then was followed by representative clinical evaluations as the progress of physical measures in pneumonia, histamine ionization, the rôle of electrosurgery—symposia— etc. Wednesday morning's session was replete with interesting observations on the effects of hyperpyrexia therapy and the present status of short wave therapy. Undoubtedly the latter subject has created widest interest because of its special promise in a wide variety of clinical material. Dr. Wm. L. Clark was once again elected President for the forthcoming year.

Ultraviolet Rays Destroy Snake Venom in Test Tube

Ultraviolet rays of light will destroy the toxic poisons of deadly snakes like the cobra, copperhead and rattlesnake in a test tube, it was reported to the meeting of the Optical Society of America.

The long-held hope that a new way of combating the injurious effects of snake poisons on stricken victims of a bite is yet to be realized, however. Dr. David I. Macht, pharmacologist of Baltimore, who reported the research, indicated experiments with animals showed that no antidotal effect could be observed. Only when ultraviolet rays were focused on snake venom in an open wound was a beneficial therapeutic effect obtained.—*Science News Letter*, October 27, 1934.

Conquest of Anemia One of Medicine's Great Epics

Once when a doctor shook his head and said: "pernicious anemia," it was a death warrant executed in two or three years by the slow progress of this blood disease.

In 1926 the medical world was thrilled, as it is occasionally by some great advance, by reports from Harvard Medical School that liver, the ordinary calf or beef liver of that tasteful liver and bacon dish, was capable of conquering pernicious anemia.

Today the disease fighters who made mankind unafraid of one more disease are honored for their work by that highest of science's awards, the Nobel prize in medicine.

As insulin subdued the toll of diabetes, so liver is a specific for pernicious anemia. And as the achievement of insulin was crowned by a Nobel award to the group responsible, so liver for anemia is now recognized.

Like many great discoveries in science, the conquest of this disease of the bone marrow, a disease that prevents the formation of enough vigorous red blood cells, came slowly. The first act occurred in the animal experiment laboratories of Dr. George H. Whipple of the University of Rochester. The second act came when Dr. George R. Minot of Harvard Medical School seized upon Dr. Whipple's results and reprieved by the grace of science pernicious anemia patients.

It seemed simple after it was done. The patient ate large quantities of liver—as much as half a pound a day. That is, it was simple if the patient

happened to like liver but most of them did not.

Since then the treatment is dietetically less heroic for the material in liver that counteracts the disease has been extracted and it is only necessary for the patient to take relatively small doses of extract.

But in the early days, the patients ate liver and they had to like it. One incidental effect when the news got around was that perfectly well people who did not need to eat liver to save themselves from death decided to eat more liver. The price shot upward under increased demand which did not help the economics of combating the disease.

Within the first four years after announcement of the treatment in 1926, life insurance statisticians found that mortality from this disease for white persons had been reduced by about half between the ages of 55 and 74 years in which range formerly the heaviest mortality from this disease had occurred. At the same time, pathologists in medical schools were finding themselves hampered in their teaching because they could not find a sufficient number of patients suffering from the disease to be used in showing medical students how this disease affects the body.

Perhaps it was because he suffered from diabetes and thus learned first-hand the vital importance of scrupulous attention to diet that Dr. Minot discovered the value of liver in treating pernicious anemia. According to reports, it was while he was weighing every morsel of his own food, before the discovery of insulin, that he began to investigate the eating habits of his pernicious anemia patients. He found them finicky eaters, over-fond of fats and disliking meat and other protein foods. Then he heard of Dr. Whipple's laboratory experiments.

The University of Rochester scientist had given dogs another kind of anemia—simple anemia—and had found that feeding liver or muscle meat cured their anemia. Dogs do not get pernicious anemia, and the two kinds—simple and pernicious anemia—are quite different. Furthermore, muscle meat such as beefsteak had never helped pernicious anemia patients.

Still, Dr. Minot decided to give liver a trial, perhaps spurred on to this decision by the knowledge that liver was being found valuable in pellagra and sprue, two diseases which had certain similarities to pernicious anemia.

The striking improvement in the first liver-fed pernicious anemia patients seemed too good to be true, so Dr. Minot enlisted the unprejudiced aid of another physician, Dr. William P. Murphy of Harvard Medical School. Without telling Dr. Murphy of his own results and hopes, he persuaded the latter to try liver feeding for pernicious anemia. When Dr. Murphy's liver-fed patients showed the same striking improvement Dr. Minot felt sure enough of the method to make the first public announcement at a scientific meeting.—*Science News Letter*, November 3, 1934.

Vitamin Structure Secrets Probed With Ultraviolet

Vitamin B₁, one of the earliest members of the now famous family of vitamins, and also one of the most mysterious, is beginning to yield its secrets. Dr. Francis F. Heyroth and Prof. John R. Loof-

hourow, of the Basic Science Research Laboratory, University of Cincinnati, investigating crystals of vitamin B with ultraviolet light, have found that they are built on the type of a substance known as pyrimidine, which contains a group of atoms made up of four carbons and two nitrogens in a ring. (*Nature*, Sept. 22.).

The eventual discovery of the structure of the vitamin is important because it may lead to its preparation synthetically. A deficiency of vitamin B₁ in the diet of man leads to the disease known as beri-beri.

The difficulty in determining the chemical structure of the vitamins lies in the fact that the preparations have very great potency and the scientists can not easily tell whether the activity of the substance isolated is not due to some small content of an associated substance. Several samples of material used by Dr. Heyroth and Prof. Loofbourow came from Dr. Atherton Seidell of the U. S. Public Health Service's National Institute of Health. — *Science News Letter*, November 3, 1934.

Anemia Research Began With No Thought of Application

Unpredictable by-products of research in physiology are rarely brought to the attention of the layman.

The studies which led to the appreciation of liver as a food to promote hemoglobin regeneration were taken up with no idea of any clinical application. We wished to find out how the body built up hemoglobin and what materials could best be utilized by the body.

These studies are still being carried forward to determine what elements of food are most essential to make new hemoglobin. Dogs are best suited for these studies and all work has been done on these animals. They are frequently used to standardize liver fractions to be used in the treatment of human disease.

Future progress in the control of other diseases can not be predicted with any certainty, but if history has any significance it points to future by-products coming from investigations in the wide field of pure science which will enable the physician to bring under control still other diseases which afflict human kind.

It is never safe to state that any bit of accurate knowledge about body physiology is useless for in the future some student may sense its application to the study of some particular disease state. Progress is often made by way of detours which look very unfavorable at first. — *Science News Letter*, November 3, 1934.

Artificial Radioelements for Medicine

Artificial production of radioactive elements useful in medicine and superior in intensity to radium was predicted by the famous husband-and-wife scientific team, Prof. F. Joliot and Irene Curie of Paris, who discovered artificial radioactivity less than a year ago.

Speaking before the International Conference of Physics, at London, the Joliot's expressed their hope of producing superior radioactive elements

with useful properties not possessed by the radioactive substances in the development of which the famous parents of Mme. Joliot played such an important part.

These powerful radioelements that the Joliot's foresee when introduced into the living body must, they declared, behave very differently because of their chemical properties and the fact that they will disintegrate without leaving a radioactive residue.

This has great possibilities in medicine. It may mean a new kind of cancer treatment in which artificial radioactive substances produced cheaply can be introduced directly into the cancerous tissue to do their work, and then become harmless.

The Joliot's speculated upon just what happens within the central portion of the atom when it becomes artificially radioactive. They attributed the emission of electrons and positrons to what they called an "internal materialization" of gamma radiation, radiation of the same kind as light and x-rays. The gamma radiation, they suggest, is transformed into a positive and a negative electron in the process of leaving the central portion or nucleus of the atom which gave rise to it. In this manner neutron radiation and gamma radiation are emitted when beryllium is bombarded with the cores of helium atoms, called alpha particles, which are shot off from the naturally radioactive substance polonium.

But the Joliot's found it difficult to imagine what happens within the atom's heart when neutrons are the bombarding particles. A possible interpretation is that the entrance of a neutron is followed by an expulsion of a negative proton, a particle that has not yet been discovered.

This expulsion of a negative proton might explain the formation of a substance heavier than any hitherto known, chemical element 93. Such an element has been reported by Prof. Enrico Fermi of Italy but doubt has been cast upon its actual existence.

Certain experiments, the Joliot's reported, suggest that neutrons bombarding phosphorus could produce radioelements themselves emitting protons.

Natural radioelements, like radium and uranium, are pronounced by the Joliot's to be apparently rare survivors of numerous elements which existed under conditions of temperature, pressure and radiation different from those existing now on earth. This must have been millions of years ago. — *Science News Letter*, October 13, 1934.

Insects Are Electrocuted in New Research Traps

Electrocution is the latest method of controlling orchard insect pests at Massachusetts State College. Prof. A. I. Bourne, Stewart D. Edmond and Prof. C. I. Guinness are studying the effectiveness of five electric insect traps in a local apple orchard to determine the practicability of the method on a wide scale.

Each trap consists of a double wire screen enclosing a 75-watt frosted bulb. The light at-

tracts insects at night but as they fly toward it they come in contact with the electrified screen wire. Currents at 110 volts cremate them.

Some are only killed, however, and fall to a tray beneath the trap. The present installation of five traps is already known to have killed 1,300 insects in a single night, not counting those so completely destroyed that identification was impossible.

The many potential uses of such traps, Dr. Bourne declares, are only now becoming known. Besides destroying many insects the traps are useful in determining spraying schedules, as an examination of the catch each morning will show when the various insect pests are beginning to appear and their relative prevalence and distribution. — *Science News Letter*, Aug. 4, 1934.

New "Cold Light" Aids in Cancer Diagnosis

A new aid for diagnosing cancer and other diseased conditions of the breast is a powerful "cold light" which enables physicians to see through the tissues and observe directly the tumors or other abnormalities.

Clinical trial of the lamp has been made at the tumor clinic of the Michael Reese Hospital, Chicago, under the direction of Dr. Max Cutler, who terms it "a simple, safe and valuable aid."

Transillumination, seeing through body tissues with the aid of a strong light, is not a new procedure in itself, but this new lamp, powered by a 750-watt bulb, is said to provide much more intense light than other lamps hitherto used. A wall of circulating water cools this lamp so that it can be applied directly to the skin with safety and comfort for the patient. This enables the physician to bring the light close to the tissues he wants to see.

Technical and mechanical problems in the construction of the lamp were worked out in the laboratories of the General Electric X-Ray Corporation. — *Science News Letter*, Aug. 4, 1934.

Magnetic Objective for Electron Microscope

A microscope which uses electrons instead of light rays to "see" tiny objects has been developed by Dr. E. Ruska and reported in the German scientific publication *Zeitschrift für Physik*. By magnification in two stages the German scientist has obtained a device capable of enlarging the apparent size of things some 10,000

times. The maximum magnification usually possible with ordinary optical instruments is 3,500 times.

Whether electrons or light rays are used in a microscope they must be brought to a focus. For electrons a magnetic field is used for this purpose since the electron's charge makes it react in a magnetic field.

The electron microscope, developed by Dr. Ruska, has theoretically a resolving power a thousand times greater than that of a microscope using light, because the wavelength corresponding to the electron is a thousand times shorter than that of ordinary light. But to realize this power, strongly converging or short focus objectives are required. Glass lenses cannot be used. Electric or magnetic fields take their place, and bend or converge the electron streams just as lenses bend or focus light rays.

One could use a series of low power objectives one after the other in a series of stages. But this would make the microscope unduly long and cumbersome. The development of a high power magnetic objective that will give a magnification of 10,000 diameters in two stages is therefore a considerable step in advance. — *Science News Letter*, Aug. 4, 1934.

Egyptian Teeth

Decayed teeth were more prevalent among upper class Egyptians than among the peasants who ate simple, coarse foods, a study of ancient skulls shows.

Condolence to Dr. Clark

The Congress wishes to extend at this time its sympathy to our President Dr. William L. Clark in the recent passing of his beloved Mother.

Obituary

The Congress wishes to announce the death of one of its members, Dr. James David Edwards of St. Louis, Mo.

Correction

We regret that in the October issue the name of Dr. Francis L. Lederer was given as Francis M. Lederer.

THE STUDENT'S LIBRARY

CORRECTIVE PHYSICAL EDUCATION. By *Josephine Langworthy Rathbone*, M.A., Instructor in Physical Education, Teachers' College, Columbia University. Cloth. Pp. 292. Price, \$2.50. Illustrated. Philadelphia: W. B. Saunders, 1934.

In a conference on teaching of physical therapy it was stated by a member of the Council on Physical Therapy that 90 per cent of the necessary work in a general hospital so far as physical therapy is concerned can be accomplished by exercises, massage, muscle training and posture work. Therefore, a book on corrective exercises should be of interest to every member of the medical profession.

This book is designed for students of physical education and the first 100 pages are devoted to a review of anatomy, the mechanics of joint action and the physiology of the neuromuscular system. Chapters IV and V consider faulty development and its correction. The types of poor posture and their causes are discussed for the student of reconstructive physical education. It is emphasized that these students should appreciate their limitations in dealing with these cases and should be prepared to follow a doctor's instruction when the doctor feels that physical education activities will help to correct or compensate for the condition. If this is so it would seem that this book is valuable to the physician, so that he will be familiar with the exercises and methods used in physical education. Chapter V gives an exercise program for reconstructive or corrective physical education.

The balance of the book considers orthopedic lesions, physical therapy in the treatment of mental and emotional maladjustments and the school problem in regard to physical education. These chapters are especially intended for students in physical education and have little interest for a physician. Considering this work as a whole it would seem to have more appeal to the students and teachers of physical education rather than to physicians except where the latter have specialized in this field of endeavor.

BATHS AND MEDICINAL WATERS OF BRITAIN AND EUROPE. By *Michael G. Foster*, O.B.O., M.A., M.D., Fellow of the Royal College of Physicians, formerly Temporary Colonel Army Medical Service. Cloth. Price, 12/6. Pp. 225. Bristol, England: John Wright & Sons, Limited, 1933.

The author has had forty years' experience in the treatment of chronic diseases. He is convinced that many who suffer from chronic maladies do not sufficiently avail themselves of the means which would both increase their efficiency, and add to their enjoyment of life. This book is valuable to the physician when advising a patient on the selection of a

spa in Europe, as the last half of the book is devoted to a consideration of the individual spas of the British Isles, France, Italy, Spain, Algeria, Switzerland, Germany, Austria, Czechoslovakia, Roumania, Portugal, and Egypt. Any physician interested in hydrotherapy will appreciate the information contained in the chapters on diseases suitable for spa treatment and the internal use of natural medicinal waters and their curative effect in the large number of affections listed.

THE CONTROL OF FOOTBALL INJURIES. By *Marvin A. Stevens*, M.D., Assistant in Surgery, New Haven Hospital and Head Coach, Freshman Football, Yale University; and *Winthrop M. Phelps*, M.D., Professor of Orthopedic Surgery, Yale University. Cloth. Pp. 241. Price \$3.00. New York: A. S. Barnes and Company, Inc., 1933.

This book is written by a football coach and an orthopedic surgeon. The combination has produced a book that is invaluable to those interested in the prevention and treatment of football injuries. The control of football injuries involves the prevention of injury by the coach and trainer and the treatment by the surgeon. Therefore, two technical terminologies, that of the game and that of medicine, have been included in the book. The authors believe the inherent dangers of football have been greatly exaggerated. They believe that football unless it is played for fun has little justification for its existence, and that the "grind" and training are worthwhile in that they teach the youth how "to take it" and "how to hand it out" in a sportsman-like manner. The volume is well illustrated and discusses training and physical equipment, the use of physical therapy in football and athletic injuries, types of football injuries and their control. It should be read by every surgeon treating athletic injuries.

PSYCHOTHERAPIE. Ein Lehrbuch für Studierende und Ärzte. (Psychotherapy. A Text-book for Students and Physicians.) By Privatdozent Dr. *Heinrich Kogeler*, Vienna. Cloth. Pp. 167. Price: 10 Marks. Vienna: Wilhelm Maudrich (American Agency: Chicago Medical Book Co., Chicago) 1934.

The subtitle is somewhat inappropriate in that the present monograph is not a text-book in the common acceptance of that designation, the arrangement of the text being in fact far superior to that usually found in standard books. The small work is primarily intended for general practitioners to guide them in their private practice, both with regard to the recognition and the office or home treatment of the more common psychopathic af

fections. Indeed the author bases his practical experience on observations made in a Vienna psychiatric dispensary, an interesting history of which is presented in two pages.

The text proper is divided into a general and a special part. In the former a brief chapter is devoted to the history of psychotherapy. This is followed by an exhaustive study of the personality of the physician, of his rôle in relation to patients, and of his methods of approach for diagnosis. In another chapter on psychotherapy the author reviews the different concepts of suggestion, hypnosis, psycho-analysis, and the like. Such known schools of thought as those of Freud, Adler, Charcot, and others are critically reviewed, as are the teachings of less known exponents, such as Mesmer, Coué, Jung, and others, irrespective of their classification as orthodox or heterodox adherents of school psychiatry. A chapter on the causes of psychic disturbances concludes the general part of the volume. It is undoubtedly one of the best efforts in contemporaneous literature.

The special part dealing with symptomatology takes up psychasthenia, hysteria, the diverse psychoses and their borderland conditions. This part of the book contains many illustrative clinical histories, which visualize the methods of arriving at a diagnosis and of the most appropriate treatment in individual cases. It is noteworthy that in most of the cases the sex element plays an important rôle. An excellent index concludes this valuable and authoritative guide to every-day psychotherapy.

THE INTERNATIONAL MEDICAL ANNUAL. A Year Book of Treatment and Practitioner's Index. Editors: *H. Letheby Tidy*, M.A., M.D., Oxon., F.R.C.D., and *A. Rendle Short*, M.D., B.S., B.Sc., F.R.C.S. Cloth: Price \$6.00. Baltimore: William Wood and Company. 1934.

The editors in their introduction state that The Medical Annual is in the main a conspectus of current medical literature, and in this respect its contents are limited by what has been published during the year. Careful consideration is also given each year to the selection and inclusion of special articles of practical value written independently of the literature. The introduction serves to indicate, in the least possible space, for the benefit of the most impatient reader, the newer methods of diagnosis and treatment and the principal topics of interest that the year has produced.

That such a volume is of great value and interest is recognized by most practitioners. It is extremely difficult for the busy doctor to read even a small portion of the current medical literature, and, unless the subjects are classified and the material abstracted, the physician who is desirous of keeping abreast of the times would find it difficult to do so. The Annual fulfills this requirement and therefore serves a most useful purpose. The index makes it possible to refer to any of a large variety of subjects, thus enabling close touch even by hurried reference with the newer expositions in every specialty of medicine. The Annual is recommended as a valuable addition to every medical library.



INTERNATIONAL ABSTRACTS

Effects of Ionization on the Mucosa of Frontal Sinuses of Dogs. Bernard J. McMahon.

Ann. Otol., Rhinol., and Laryngol. 43:643 (Sept.) 1934.

The author undertook this study because he believed that there was need for a scientific explanation for the results obtained with ionization. He therefore determined to analyze the actual tissue changes brought about by the procedure. The work was done on the normal mucosa of the frontal sinuses of dogs with certain solutions used in routine intranasal medication. The electrolytes were chosen on account of their clinical usages with the hope that some practical applications might be adduced from the findings.

The author's summary follows:

It is noteworthy that the principal reaction of the mucosa to the silver colloids was cytologic, a localized leucocytosis, and that this was not any more pronounced as a result of ionization, or any less pronounced without ionization. That is to say, an ionizable solution may react spontaneously to the electrical forces of the tissues themselves, when contact is made for a sufficient length of time, and thus enable the constituent ions to penetrate into the mucosa and instigate an appropriate reaction. According to this hypothesis, ionization has no advantage over passive contact within a cavity lined with mucous membrane, in so far as the local tissue reaction is concerned. But whether this may mean that ionization is ineffectual or that normal tissues possess an ionization limit beyond which they cannot be stimulated, we are not prepared to say.

The marked hyperemia alone did not necessarily cause an excess of leucocytosis in the tissues. The fact that negatively charged carbon particles suspended in a suitable electrolyte were driven into the epithelium demonstrated the power which ionization does possess to facilitate the invasion of otherwise inert foreign particles.

That certain destructive changes may be brought about was shown by the marked fragmentation of the epithelium, the edema of the subepithelial tissues and the subepithelial hemorrhages which occurred in the mucosa of the sinuses ionized with zinc sulphate solution.

On account of the small number of subjects studied, these results may be interpreted only as an indication of the effects which ionization of certain solutions may have upon a sinus mucosa, and will need further confirmation by more extensive experiments before definite conclusions can be drawn.

The author's conclusions:

1. Definite destructive changes were brought about in the mucosa of the frontal sinuses of dogs by the ionization of the zinc sulphate solu-

tion. These changes consisted of ballooning, fragmentation and complete destruction of the surface epithelium, a marked edema of the subepithelial tissues and an extravasation of free red blood cells into these tissues from greatly dilated and ruptured capillaries.

2. The specific response of these tissues to the ionization of silver colloids is a polymorphonuclear leucocytosis.

3. The general response of the mucosa of the frontal sinuses of dogs to a galvanic current is an engorgement of the capillaries of the subepithelial tissues.

A Dosage System for Gamma Ray Therapy. Ralston Paterson.

Brit. J. Radiol. 7:592 (Oct.) 1934.

The author describes a practical system of dosage measurement applicable to all forms of radium therapy other than certain types of interstitial implantation. The international "r" unit is accepted as a satisfactory unit of quantity of gamma radiation, and the Imc. Hr. of Sievert assessed as equal to 8.4 "r." Graphs are submitted showing for various distances the amount of radium required on any applicator to produce a dose of 1,000 "r" over any desired area. A system of "Rules" is also given, defining how, in the situations met with in actual clinical practice, radium must be distributed upon such applicators to produce a reasonably homogeneous radiation over the whole of a treated surface. The effects of certain dosages of gamma radiation on normal and malignant tissue are described. The lethal dose for squamous epithelioma appears to be 6000 "r" delivered as continuous radiation for a period of eight days; normally healthy skin safely tolerates the same dose delivered over a like period, and normal mucosa more than that. The physical and mathematical data on which the system is based are outlined.

Electrocoagulation of the Cervix. Martin S. Sichel.

Western J. Surg. 42:261, (May) 1934.

Electrocoagulation is useful for cervical infected glands which cannot be visualized on exposure with a bivalve speculum. Erosions and ectropions visible to the eye are easily treated and cured with the nasal tip cautery. The technic requires no anesthesia and may be performed in the office. Any diathermy machine may be used. A short circuit between 2,000 and 2,200 milliamperes is first produced in the diathermy instrument. The cervix is then exposed by a bivalve speculum, all discharge is thoroughly wiped away and the electrode introduced into the cervical canal until it is felt to impinge on the internal

os. It is then retracted a few millimeters and the current applied, rotating the electrode between the thumb and index finger so as to be sure to reach all areas of the cervical canal. Usually from six to ten seconds will suffice to coagulate thoroughly all portions of the cervix to a depth of three to four millimeters; the depth and amount of coagulation can be determined by the whitish coagulated area that appears at the external os; this area is usually from three to four millimeters in diameter. The patient is to be warned that there will occur a marked increase in the amount of discharge during the subsequent two or three weeks and is advised to take saline or soda douches twice daily. A week after the treatment a typical slough may be seen at the external os. By the end of four or five weeks healing is usually complete, the discharge cured, and the existing pathology relieved. Thirty-two cases are reported with 90 per cent cures and 10 per cent improvement. Three patients with dysmenorrhea were cured by this method.

Diathermy in Treatment of Pneumonia. Harry E. Stewart.

Brit. J. Phys. Med. 8:133 (Jan.) 1934.

Stewart believes that the patient who does not respond favorably in any clinical sign after three or four diathermy treatments presents an almost fatal prognosis. Large increase in diathermy dosage is indicated when the patient is improved temporarily by treatment. No other indicated measure in the treatment of the disease need be omitted because of the use of diathermy. It is one of the safest measures known to medical practice; as far as is known, no accident or untoward effect has followed the administration of some 20,000 individual treatments. The use of diathermy in pneumonia is advocated by all who have had an opportunity for clinical study of its effects. The method has a sound physiologic basis, gives the patient a measure of relief which alone would justify its use, reduces the average mortality some 70 per cent and is well worth further clinical application and study.

How to Organize a Department of Physical Therapy. Earle E. Shepley.

Modern Hosp. 42:83 (June) 1934.

The installation of an adequate physical therapy department in the hospital not only makes for better service to the patient, but it tends also to lessen the worry and anxiety of the physician who has the responsibility of providing the proper care for his patients. Because it lessens the hospitalization period, a physical therapy installation appeals also to those who are responsible for the provision of hospital finance.

As in every other medical specialty, the director of physical therapy should possess a background of wide medical experience. Not only should the prospective director possess a thorough practical and technical knowledge of the field of physical therapy, but, for the smaller institutions, he should be proficient also in ra-

diology. In larger institutions, owing to the volume of work, this arrangement may not be feasible, but it should be capable of accomplishment in the average hospital. With these qualifications, a common directorship for the two departments is possible. This situation provides for more economical administration in the hospital and also provides full time employment for the director.

In general a department of physical medicine should be bright, airy and convenient for the out-patient as well as for the patient domiciled in the institution. Access to water, electric power, sewers, elevators, exits and various clinical departments must be most carefully studied.

The size of the department is an individual problem. If properly organized and operated, the department can be expected to expand beyond early and modest beginnings. This should be kept in mind. Physical therapy can be subdivided into several major departments. The more important of these are radiotherapy, electrotherapy, phototherapy, actinotherapy, mechanotherapy, massage and hydrotherapy. The particular equipment to be selected by the director will depend upon the predominant type of service that the department is called upon to render. In some physical therapy departments one finds one or more of these major subdivisions being practiced, in whole or in part, to the practical exclusion of all the others. However useful this limited procedure may be in certain selected cases, it is not to be accepted as other than the practice of a small corner in the field of physical therapy, and in general hospitals, in fairness to the patients that are to be served, there should not be too much limitation in the variety of apparatus installed; each modality has its own specific use. Recommendation is made for different electrical and physical agencies.

A New Instrument for Intravesical Irradiation. Oswald S. Lowsley, and Stanley L. Wang.

Arch. Surg. 29:85 (July) 1934.

Since ultraviolet radiation has been useful externally it is reasonable to think that it might have a good effect in the bladder if it could be suitably applied. No attempt was made to select the patients for these irradiations, as many have lesions in the bladder which are very extensive and functions are probably partially crippled. Hence no conclusion can be drawn except that postoperative treatment of this kind is indicated after nephrectomy with small and early lesions in the bladder. Several patients with large involvement have even thought that there was lessening of sensitivity in the bladder. This form of treatment seems better tolerated than any other local treatment tried. The application is practically painless, and hence successful. It is suggested that this form of irradiation might have some field of usefulness in urology other than in the treatment of urologic tuberculosis. Eighty-five per cent of the generated light is said to be in the band of 2,537 angstrom units, which is considered bactericidal. Caulk and Ewerhardt noted

the disappearance of an infection by colon bacilli in their patient after four periods of irradiations. Other observers have reported that the use of a quartz mercury vapor arc lamp is effective against colon bacilli. The instrument we have used seems to be satisfactory for emptying the bladder, introducing air and irradiating the wall of the bladder. In the series of patients treated the results have been encouraging and warrant further trial of the procedure.

This instrument may also be used to treat sinus tracts caused by tuberculosis in any part of the body.

Treatment of Hydrocephalus by Endoscopic Coagulation of the Choroid Plexus. Tracy J. Putnam.

New England J. Med. 210:26:1373 (June 28) 1934.

A new endoscopic instrument is presented with which it is possible to destroy the choroid plexuses within the lateral ventricles by means of electrical coagulation without removal of spinal fluid. The procedure has been used in seven cases of communicating hydrocephalus in infants and one of meningocele without hydrocephalus with encouraging results so far. Bulging of the fontanelles has been relieved and the diameter of the head has been decreased in all cases except one. The coagulating ventriculoscope in its present state consists of a rod of optical glass with polished ends. The ventricular end is plane, while the observer's end is ground with a slight curve of which the focal length is approximately equal to the length of the instrument. The rod bears a deep longitudinal groove in which lies a tiny bronchoscope light and its carrier. Two other smaller grooves carry the electrodes for diathermy, which are cemented to the glass and covered by an insulating enamel. The tips of the electrode are bare, and are bent slightly toward each other so that they appear in the field of vision. The instrument is sterilized by immersion in alcohol and is encased in a tube of rubber dam when in use. The ventriculoscope is made in two sizes, one ten centimeters long and six millimeters in diameter, the other eighteen centimeters long and seven millimeters in diameter. There have been two deaths in the series, both due to intercurrent diseases, and possibly not to be attributed to the operation. The intracranial pressure was relieved up to the time of death in these cases also.

The Radiation of Heat From the Human Body. III. The Human Skin as a Black-Body Radiator. James D. Hardy.

J. Clin. Invest. 13:615 (July) 1934.

Additional evidence has been collected which supports the conclusion of Cobet and Bramigk concerning the emissivity of the skin for infrared light. The value of the emissivity is put at 100 per cent with a possible error of 1 per cent. Tests of the emission curve of the human skin

show: (1) that it radiates like a black-body irrespective of its visible color; (2) that the energy distribution in the spectrum is similar to that of an artificial black-body radiator; (3) that the presence of water vapor and CO₂ in the layers of the air next to the skin do not appreciably affect the radiation from the surface. The validity of skin temperature measurements by means of a radiometer is upheld as regards the emissivity of the skin.

Physical Therapy Committees in State and County Medical Societies—An Outline of Organization and Plan of Activities. Richard Kovács.

J. A. M. A. 102:1296 (April 21) 1934.

The initiative for the organization of physical therapy committees in county or state societies must come from the local society membership.

The chief tasks confronting committees on physical therapy are to impress on the rank and file of the medical profession that (1) the rational use of physical measures is part of the practice of medicine; consequently the members of the medical profession must receive adequate postgraduate instruction in physical therapy from competent leaders, and that (2) the practice of physical therapy by unlicensed people and its independent practice by lay technicians should be prevented by medical practice statutes.

The main aim of a successful physical therapy committee should be the inauguration of suitable instruction concerning scope and methods of physical therapy. This can be done through single lectures at the stated meetings of the medical body or by special postgraduate courses arranged for all members of the society, no charge being made. Although the content of the course may be varied to suit the local needs, the following five-lecture postgraduate program has been suggested:

First lecture: Heat measures, therapeutic effects.

Second lecture: Massage, therapeutic exercise.

Third lecture: Hydrotherapy. Physical therapy in medical conditions.

Fourth lecture: Ultraviolet radiations. Physical therapy in surgical, gynecologic, and other special conditions, low frequency currents and electrodiagnosis.

Fifth lecture: Inhalation therapy. Use of oxygen, carbon dioxide, and so on, in resuscitation, anesthesia and pneumonia.

Manufacturers of physical therapy and x-ray apparatus or their representatives may be asked to cooperate with the committee's efforts to raise the standards of physical therapy. Those who wish to remain in the good graces of the organized profession might well be advised to pledge themselves not to establish or promote any commercial lecture course, relying only on those which are given under the auspices of the organized medical profession. Leading manufactur-

ers in conference with physical therapy committees have subscribed to the principle that instruction in diagnosis and therapeutics belongs solely to the province of the medical profession. The only instruction that an ethical manufacturer can consistently offer to the profession is on the manipulation and care of some certain type of apparatus.

Treatment of Hay Fever and Its Allied Conditions by Ionization. Preliminary Report. Harold L. Warwick.

The Laryngoscope 44:173 (March) 1934.

Warwick reports on the work of Demetriades and Franklin with ionization in hay fever. Due to his dissatisfaction with the usual treatment of hay fever, Warwick was led to experiment with ionization, and for the past seven years he has used this method to the exclusion of all other forms of treatment.

This author describes his technic which in the main is similar to that employed by others for several years. He advises submucous resection as a preliminary measure, if marked deviation of the septum exists, as ionization cannot be carried out satisfactorily unless the nasal chamber can be completely packed. Later, ionization is depended upon to relieve the hyperesthetic symptoms.

Warwick states: "The real criterion of efficiency of any allergic treatment is the permanence in the relief of symptoms secured for the patient. Because of this, I am not reporting any of my recent cases but am including only those cases which have been entirely relieved of their symptoms for more than one year. All the patients reported here had hay fever as their major allergic manifestation, but 10 of them were complicated with other manifestations of the disease. Four of them suffered from asthma in addition to their hay fever, and six had perennial hyperesthetic rhinitis. All but one of these patients have been entirely relieved of their symptoms for more than a year, and 19 of them for more than three years.

"Thirty-one in this group of 40 patients required only one ionization for complete relief,

seven required two ionizations, and in one of them it was necessary to repeat the ionization for the third time before permanent relief from symptoms was obtained. One case was entirely relieved of symptoms for one year, then returned and was given two more ionizations without any relief whatsoever. I am entirely at a loss to understand the failure to secure a result in this case. All but eight of these patients had had the sensitization tests and in 14 of these there were other positive reactions present in addition to the autumnal pollens. Several of them had, in addition to the hay fever, food sensitivities and the majority of these patients after ionization apparently lost their sensitivity to these foods because contact with them no longer produced nasal symptoms. Eight of the total group had received no treatment whatsoever for either the hay fever or the other symptoms, while 32 of them had had all sorts of therapy, including the desensitization by vaccines, local treatment and nasal operations, all without relief from their symptoms."

In 16 of these patients, done more than three years ago, the reactions following ionization were much more severe than in recent years, due, according to the author, to a modification of the electrode and the electrolyte. The latter now consists of cadmium and tin in addition to the zinc.

No explanation is offered concerning the action of ionization on the allergic nose, but the opinion is ventured that the change which occurs is not local but systemic in nature.

Eye Sarcoma of Rats, Caused by Prolonged Ultraviolet Irradiation. K. Huldshinsky.

Deutsche med. Wchnschr. 59:530, 1933.

By exposure of five rats to a quartz mercury lamp for two hours daily for about one year, eye sarcoma could be produced in all irradiated animals, derived of the cornea. Of seven rats similarly exposed to a Solarca-lamp, tumors occurred in three cases only. This comparison indicates that the short wave radiation has the greatest tumor producing power. The single and total doses were about 10 times as high as the average therapeutic doses.

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THE FORTIFICATION OF MILK WITH VITAMIN D *

J. H. SHRADER, Ph.D.

BALTIMORE, MD.

Within the last several years, so-called vitamin D milk has been produced in increasing quantity. This milk is mostly regular market milk which has been treated by one of several processes to increase its content of vitamin D. One well-known brand of dried milk powder for infant feeding has been artificially enriched with vitamin D for over seven years, and recently the evaporated milk industry has taken up the idea on a large scale.

The control of the several processes to yield milks with a predetermined level of potency is made with bio-assays on rats. The strength is expressed in several different units, of which the one developed by Steenbock is most generally used, although this is now being replaced by the U. S. P. X (1934) unit. One Steenbock unit is equivalent to about 2.7 of these pharmacopeial units.

Clinical Work

Cowell⁽¹⁾ fed irradiated milk to three young children with active rickets as determined by radiographic examination of their wrists, and observed a definite increase in calcification.

György⁽²⁾ fed milk which had been exposed to the sun's rays to 18 rachitic infants, of whom 16 were cured in two to six weeks.

Hess and Lewis⁽³⁾ showed from studies with about 100 infants that regular pasteurized milk could be activated directly with ultraviolet light to become anti-rachitically effective.

Stokes⁽⁴⁾ working with 21 infants confirmed the findings of other investigators as to the anti-rachitic effectiveness of directly irradiated milk.

Kramer and Gittleman⁽⁵⁾ fed vitamin D milk to 10 children suffering from rickets. Some of this milk was produced by irradiating the milk directly with the carbon arc lamp and some of it was produced by cows which had been fed with irradiated yeast. The milk was fed at two levels, namely 55 and 40 Steenbock units, respectively. Healing was

well advanced in from four to six weeks. The calcium and inorganic phosphorus concentrations of the serum followed the same course as during the treatment with cod liver oil. They report "vitamin D milk to be our most effective anti-rachitic agent."

Gerstenberger and Horesh⁽⁶⁾ fed two rachitic infants whole milk from cows which had been fed daily with 100 milligrams of irradiated ergosterol. By the use of roentgenograms and bi-weekly blood serum calcium and phosphorus determinations, it was shown that the milk possessed anti-rachitic properties.

Barnes⁽⁷⁾ reports that 15 rachitic infants were given milk each quart of which contained 150 Steenbock units of vitamin D concentrate from cod liver oil. Each child drank from 24 ounces to one quart per day. He reports that healing progressed satisfactorily in all instances.

Barnes⁽⁸⁾ further reports that 32 normal infants were completely protected against rickets from November and December until April on 50 units per quart of milk which had been enriched with cod liver oil concentrate. Six additional infants showed slight x-ray signs of rickets at the beginning of the study, but these healed gradually and definitely and in no case did the x-ray signs become worse.

Wilson⁽⁹⁾ working with 33 infants, two-thirds of whom were negroes or Italians, found that when the cod liver oil extract (Vitex) is added to milk and fed to infants, it is protective against rickets when the dosage is great enough. He points out that when milk is to be relied on for the sole supply of vitamin D during the period of most rapid growth, the minimum quantity likely to be consumed during the first four months of life — approximately one point — should contain an amount of vitamin D adequate to protect the normal rapidly growing infant. From his data he concludes that the addition of 150 Steenbock units of the vitamin D concentrate to one quart of milk did not furnish enough vitamin D to prevent the development of a moderate degree of rickets in two out of the 33 infants studied.

* Read at the Thirteenth Annual Session of the American Congress of Physical Therapy, Philadelphia, September 11, 1934.

* From the Research Laboratories of National Dairy Products Corporation, Baltimore, Maryland.

Jeans and Stearns⁽¹⁰⁾ fed three different kinds of milk which had been enriched with vitamin D; namely, evaporated milk to which had been added concentrate from cod liver oil, evaporated milk which had been directly irradiated with ultraviolet light, and regular evaporated milk plus separately given cod liver oil. All of these were adjusted to equal vitamin D strength by the rat bio-assay method.

They found these three vitamin D'ized milks to be equally effective in calcium retention. The quantity of retention observed in the group as a whole was definitely lower than the average observed in previous experiments with infants who were given larger amounts of vitamin D. No evidence of clinical or roentgenological rickets was observed in any infant in this series, although one baby did show some evidence of decreasing bone density. Also, the rate of growth in length of the group was definitely lower than the average growth of the infants who were given larger amounts of vitamin D.

Hess⁽¹¹⁾ and his associates showed from studies on 102 infants, some of them normal and some suffering from rickets, that milk from cows which were fed irradiated yeast or viosterol is an effective prophylactic agent against rickets and is curative in cases of mild rickets.

Kramer⁽¹²⁾ fed five infants from cows which had been fed with irradiated yeast. He concludes that it is as equally effective as an anti-rachitic agent as directly irradiated milk.

Wyman and Butler⁽¹³⁾ report that their clinical studies on two infants and two children showed that pasteurized milk from cows fed irradiated yeast caused healing in advanced active rickets in infants and advanced chronic rickets in children. After five minutes boiling the milk still possessed anti-rachitic properties.

Industrial Development

The pioneer work of Supplee and his associates laid the foundation for most of the subsequent commercial development of the art of increasing the vitamin D content of milk by subjecting it to irradiation with ultraviolet light. This led directly to the marketing of an irradiated dry milk in January, 1927.

Fluid milk has been successfully irradiated and marketed for about a year. The flavor is satisfactory to the public and the sales are

generally good, in spite of the fact that such milk usually sells for one cent above the price of the same grade which is not irradiated.

Vitamin D concentrates added to milk are used in many communities. The flavor of this milk is satisfactory. This milk likewise usually sells at an advance of one cent per quart.

The feeding of cows with irradiated yeast mixed with the feed has had an extensive development throughout the certified milk industry. This milk was placed in commercial production about three years ago and its use has spread over the whole country. The prices range from no advance to that of several cents per quart.

Evaporated milk is fortified both by direct irradiation before canning, and by the addition of concentrates. This development started in 1932.

Irradiated fluid milk has been sold in central Europe for over six years. It can be bought in almost any city in Germany and Austria at a price several times that of fresh bottled milk. At present the demand seems to be waning. This is accounted for particularly by the fact that the European product had a somewhat undesirable flavor, partly by the markedly higher price, and partly by the slackening demand for such an anti-rachitic agent.

In this country, so-called vitamin D'ized milk is receiving much attention. It is now marketed in the grades of certified milk, regular pasteurized market milk, dry milk powder, and evaporated milk. These milks are recognized by the Committee on Foods of the American Medical Association and their sale is permitted by the health officers of over 200 communities.

Some concern has been expressed by physicians that the marketing of foods enriched with vitamin D may be harmful by virtue of the fact that the consumer would ingest an excessive amount of vitamin D. The remoteness of such a contingency becomes clear in view of the critical examination which this very subject has received. Several investigators, particularly Bills and Wirick⁽¹⁴⁾ showed that 100 times the prophylactic dose of activated ergosterol is harmless in rats in long-time experiments; that 1000 times is just perceptibly harmful; that 4000 times overdosage is definitely injurious; and that 40,000 times overdosage is strongly toxic. If a given milk

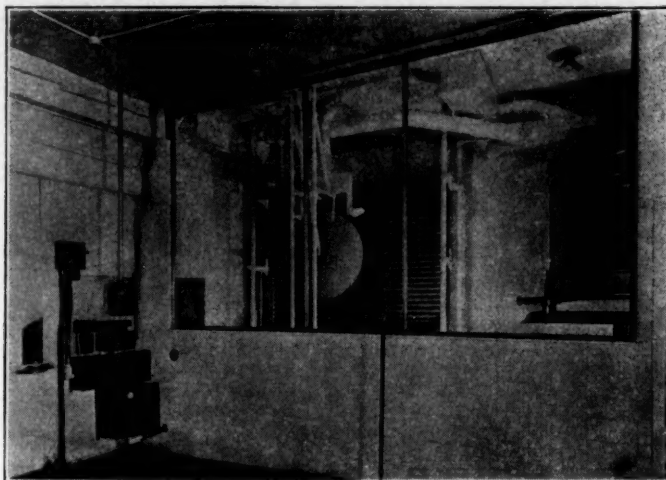


Fig. 1. — Surface Cooler Type of Irradiator with production of 3000 pounds of milk per hour.

is enriched with vitamin D to such an extent as to render the milk toxic, experience has shown that the flavor of the milk would be ruined. This would constitute its own protection against any one using it. Moreover, the great cost of using this much concentrate would constitute an additional protection against an overdose. Also, it is impossible to build up such dosages by irradiation, because beyond a given level of vitamin content any further irradiation destroys the existing potency.

The peculiar effectiveness of a vitamin D'ized milk over any other anti-rachitic treatment lies in the fact that the same medium which carries the vitamin D also supplies the calcium and phosphorus. It is recognized that vitamin D prevents rickets only by the fact that it serves to lock calcium and phosphorus into the proper metabolic function. Therefore, we could expect vitamin D in milk to be anti-rachitically more effective than vitamin D when taken independently of such a mineral food. This expectation is supported by animal experimentation and some preliminary clinical evidence.

Most of the anti-rachitic milks now marketed in this country taste just like regular milk. Their use involves no additional burden on those who take care of the infants. The milk is standardized to a constant anti-rachitic strength and is handled just like any other milk.

Finally, the newer knowledge of the rôle of diet in dental caries together with a greater appreciation of the significance of calcium

and phosphorus metabolism in optimum nutrition, places vitamin D milk in the category of a food which is of great value to adolescents and adults.

There is great confusion as to whether or not vitamin D milk of the different processes but of equal anti-rachitic potency, as determined by the standard rat bio-assay, is likewise equal in its clinical effect on infants. There is also difference of opinion as to what should be the proper anti-rachitic potency. There is a growing tendency to increase its strength so as to have more assurance of satisfactory prophylaxis and healing.

Irradiation

Out of the early work of Dr. G. C. Supplee a practical process was developed for irradiating milk under commercial conditions. His earlier experiments were conducted with a mercury vapor lamp, but a lack of constancy in its performance led him to favor the carbon arc lamp. In collaboration with the National Carbon Company he worked out a practical commercial irradiating unit which could be adapted to regular milk plant operations at a reasonable cost.⁽¹⁵⁾ This set-up is now known as the Surface Cooler Type of Irradiator.

Surface Cooler Type of Irradiator. This equipment is probably the simplest and cheapest installation for increasing the vitamin D content of milk by direct irradiation with ultraviolet light. It consists in suspending carbon arc lamps immediately in front of regular milk coolers. As the milk in the ordinary

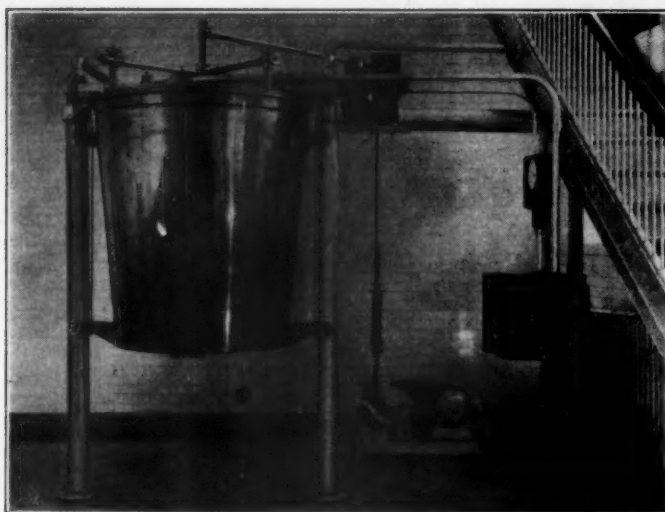


Fig. 2. — Installation of C-P Milk Irradiators in a Milk Plant, showing Sealed Capacity Milk Pumps with Control Cabinet and Recording Ammeter.

process of cooling flows down over the corrugated surface of an ordinary milk cooler, it is flooded with ultraviolet light. Figure 1 shows an installation for handling 3000 pounds of milk per hour with a so-called "U" carbon lamp. The pump is metered so that it will deliver a constant volume of milk. This type of irradiator is the one that was used to irradiate most of the milk which has been used in clinical tests and has been used to irradiate several large milk supplies, both fluid and dried. The milk produced by this equipment carries the seal of approval by the Committee on Foods of the American Medical Association.

C-P Milk Irradiator. The Creamery Package Manufacturing Company, in cooperation with the National Carbon Company and the Wisconsin Alumni Research Foundation, has produced the type of irradiating apparatus which at present is in most general use. This apparatus (see Figures 2 and 3) consists of a slightly tapering metal cylinder of tinned copper 57 inches long with a diameter at one end of 50 inches and at the other of 40 inches. The cylinder is mounted on brackets which slide up and down on the columns and is balanced by counterweights within the columns so that it can easily be moved up and down for cleaning and inspection.

An automatic carbon arc lamp is suspended at the center of the cylinder and is operated at 50 volts and 60 amperes. A toggle switch to turn the light on or off is the only manual control. A ventilating fan withdraws the

ozone from the top of the equipment and discharges it to the open air. A positive fixed capacity pump meters the milk to the machine.

In operation, milk is fed at a steady and predetermined rate to a distributor trough which encircles the inside of the cylinder at the top, and flows in a thin film down the inner surface of the cylinder where it is exposed to the irradiation from the lamp. The equipment is very easy to inspect and to clean. The consumption of electrical energy is 3000 watts to irradiate 4000 pounds of milk per hour to a potency of 50 rat units (Steenbock). It is now in use in approximately 150 plants in 125 communities for the irradiation of market fluid milk and for evaporated milk. Irradiation causes no change in flavor detectable by the general public. Irradiated milk from this machine carries the seal of approval of the Committee on Foods of the American Medical Association.

Hanovia-National Unit. Although some of the earlier work with quartz mercury lamps disclosed certain difficulties, particularly in regard to the maintenance of constant intensity which at that time had not been overcome, the Hanovia Chemical and Manufacturing Company, collaborating with the National Dairy Products Corporation, has built a milk irradiating unit whose source of ultraviolet light is a mercury vapor arc. The satisfactory operation of this apparatus has been made possible through the perfection first of the lamp equipment itself, and second through

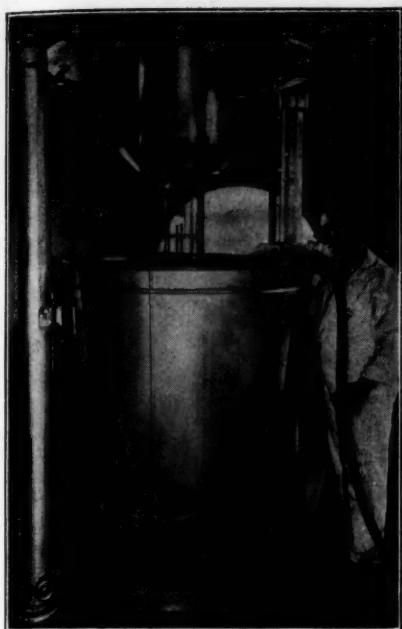


Fig. 3. — Cleaning C-P Milk Irradiator.

the development of a reliable ultraviolet controlling recorder. Figure 4 illustrates this machine.

In principle, the machine consists of a lamp placed horizontally between two inclined plates, so that its rays fall on the thin film of milk which flows down the inner surfaces of the plates. The milk film under these conditions is about $7/10$ millimeter thick and the exposure time (the time required for any given particle of milk to flow down the 19 inch depth of the flow boards) is approximately three seconds. The increasing solarization of the quartz in the lamp is neutralized by automatic electrical adjustment. By this means there is a reasonably constant irradiation during the life of the lamp. This output is governed by the intensity indicated by the light sensitive cell or target located opposite the burner within the irradiating chamber, and from there transmitted to the ultraviolet recording meter. The entire operation is automatic and removes all guess-work in the results. It also provides a timed record which is always available for the inspection of the management and public health officials. The commercial size irradiating unit occupies a floor space of two feet by five feet and has a capacity of 1250 pounds of milk per hour. A smaller one of half of this capacity is being made for installation in hospitals.

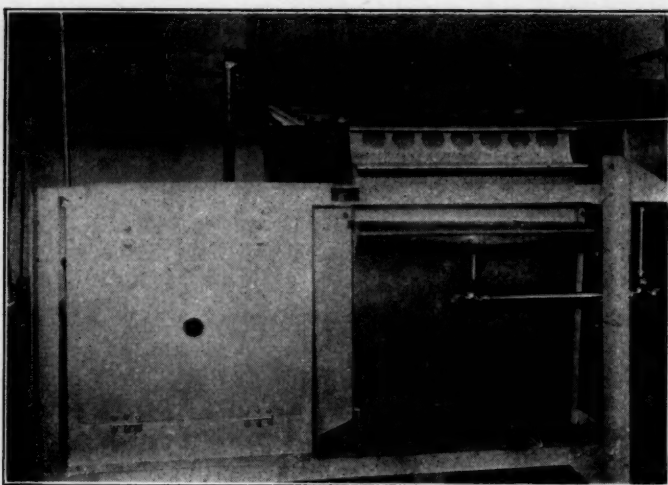


Fig. 4. — The Hanovia-National Irradiating Machine.

This machine is now in successful operation to activate milk to a level of 50 rat units (Steenbock) per quart of milk. It will activate evaporated milk to 110 units per quart. No alteration in the flavor of the milk after treatment with this machine can be detected by the most critical tasting.

"Double Bubble" Milk Irradiator. This device was invented by Dr. Brian O'Brien, of Rochester University, and the present machine was designed by him and built by the Cherry-Burrell Corporation. The idea of the machine is to produce a very thin film of milk and to expose it to the biologically active rays for an extremely short time.

In principle the machine consists of a central carbon electric arc. A gas-tight curtain of water is interposed between the flaming arc and an outer curtain of milk. This arrangement prevents any ozone from coming into contact with the milk.

Figure 5 shows the carbon arc electrodes surrounded by the flowing film of water. This water film is nearly cylindrical, somewhat approaching the hour-glass shape. It is approximately 0.009 inch (0.23 millimeter) thick and is three inches in diameter. An exhaust fan removes the ozone.

Figure 6 shows the milk film which also is approximately cylindrical, surrounding the carbon arc and also surrounding the inner water bubble. This machine is designed to irradiate 4000 pounds of milk per hour. The milk bubble is eight and a quarter inches in diameter as it flows from the orifice, and

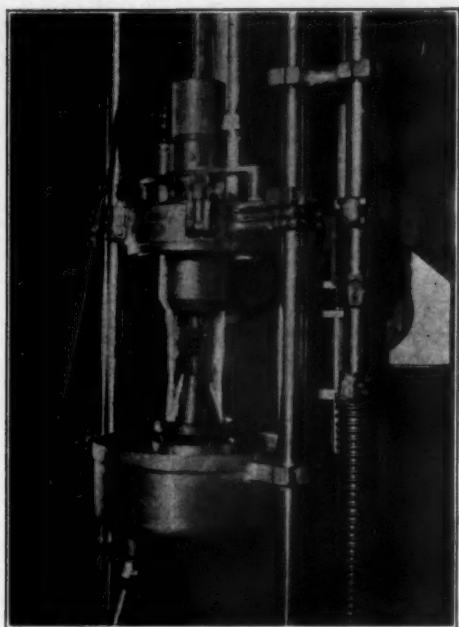


Fig. 5. — The Carbon Arc Electrodes surrounded by a Flowing Film of Water.

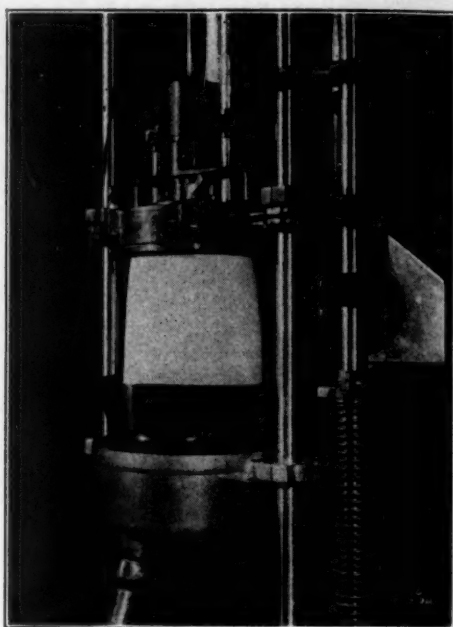


Fig. 6. — The Milk Film surrounding the Carbon Arc and the Inner Water Bubble.

the milk film is approximately 0.007 inch (0.18 millimeter) thick. Experimental tests have shown that there is no difficulty in obtaining a potency of better than 50 Steenbock units of vitamin D per quart. It is claimed that the same milk can be irradiated several times over in the device without injury to its flavor.

Other Methods of Milk Irradiation

The RUV Company which has been building ultraviolet ray equipment for the treatment of water and for the production of vitamin D in yeast, has now built a specially designed one for the direct irradiation of milk. (See Figure 7.)

This irradiator utilizes the hot anode type quartz mercury vapor lamp which has been used successfully during the past seven years for the irradiation of yeast and ergosterol. The quartz lamp which produces the ultraviolet rays is surrounded by a water cell which prevents the heat and ozone from reaching the milk. The apparatus is designed so that it is easily taken apart and all parts are easily inspected and cleaned. The machine as illustrated occupies a floor space of about three by 10 feet, uses about 1000 watts, and produces 50 vitamin D units (Steenbock) per quart in 6000 pounds of milk per hour.

Vitamin Technologists, Inc., Los Angeles, have applied the so-called cold quartz irradiation lamp of the Electro-Therapy Products Corporation to the irradiation of milk. The cold quartz lamps come in the form of long tubes of small diameter. These are mounted horizontally in front of a milk cooler. Proper reflectors concentrate the light on the milk surface while the milk flows over the cooler. The amount of current which is used to activate these lamps is said to be very low because of the high efficiency in producing maximum irradiation in the ultraviolet region and a minimum in the actinic region. It is claimed that this apparatus will activate milk to a potency of over 200 Steenbock vitamin D units per quart. The so-called electrodeless discharge has been used for the production of vitamin D in milk. When milk is allowed to flow down over the outside of the lamp, its vitamin D content is increased but at the same time flavor defects develop which make the process impracticable in its present state of development.

Vitamin Concentrates

In parallel with the development of processes to impart vitamin D to milk by direct irradiation with ultraviolet light, there has been an increasing tendency to vitaminize milk by adding so-called vitamin D concen-

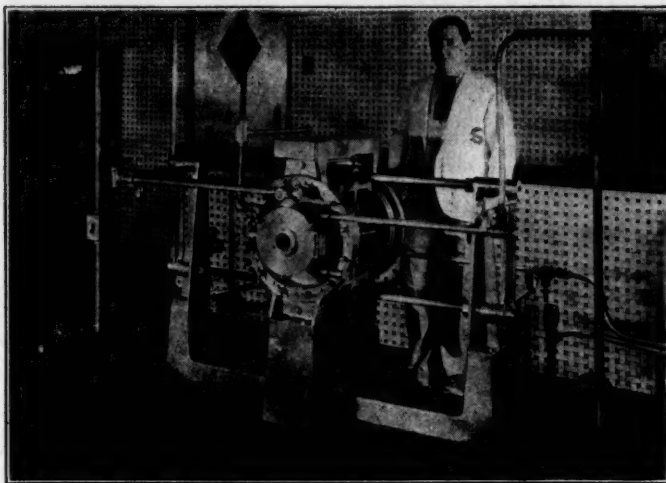


Fig. 7. — The RUV Milk Irradiator.

trates. These are prepared by two general methods, namely, the extraction of the vitamin concentrates from the unsaponifiable fractions of the fish oils; and the activation of ergosterol by direct irradiation and the suspension of this in vegetable oil to a standard strength. The best known of these are Vitex and Sun-A-Sured vitamin D.

Vitex. Somewhat prior to the discovery of the property of ultraviolet light to impart vitamin D to various products, several workers became engaged on the problem of extracting vitamin D fraction from cod liver oil. Dr. T. F. Zucker⁽¹⁶⁾ succeeded in producing a concentrate of a quality satisfactory for mixing with milk without impairing its flavor. This product is called "Vitex" and is produced by the National Oil Products Company, Newark, New Jersey. Essentially it consists of an extract of the unsaponifiable fraction of cod liver oil, which has been dissolved in sesame oil and adjusted to a constant potency of 2000 Steenbock units per gram. Their latest improvement is to use cream as a carrier instead of the oil. Only a very small quantity of this concentrate is required to impart the necessary vitamin potency to milk. The common practice is to emulsify it with about one quart of milk and then mix this thoroughly into a tank of milk.

The Committee on Foods of the American Medical Association requires that a milk whose vitamin D potency is fortified with Vitex must contain 150 Steenbock units per quart. Vitamin D milk of this type is being marketed in about 85 communities. It is also

being used to fortify the vitamin D content of evaporated milk.

Sun-A-Sured Vitamin D. This product is made by a new process which has developed from the earlier work of Coolidge and his associates, using electron bombardment instead of ultraviolet light to activate the ergosterol. The product is suspended in two different types of carriers, namely, in sesame oil to a strength of 2000 Steenbock units per gram, for use in milk and in butterfat to a strength of 5000 units for use in evaporated milk. When used with fluid milk or evaporated milk, it imparts no deleterious flavor. It is now in extensive use in the evaporated milk industry.

Other Processes. Irradiated yeast can be suspended in evaporated milk to impart a high vitamin D potency without imparting any off-flavor. Its clinical effectiveness has been demonstrated. This would be the cheapest way to produce vitamin D milk, but unfortunately irradiated yeast is not available for this purpose.

On the west coast a product is being marketed by Vitamin Technologists, Inc., which is claimed to be a concentrate of a purely vegetable source incorporated in an oil vehicle. The producers claim that the standard commercial concentrate is furnished with a strength of 1500 to 6000 Steenbock units per gram.

Although viosterol and irradiated yeast are not available for use in milk, there are coming on the market other brands of irradiated

ergosterol concentrates produced by processes which are claimed to be independent of the control of the Wisconsin Alumni Research Foundation.

Announcement has just been made of the production of a concentrate called Astra-D, made by activating the pro-vitamin, ergosterol, with sunlight alone. It is carried in sesame oil at a reported strength of about 1360 Steenbock (3672 U. S. P. X 34) units per gram.

Although the patent situation is somewhat confused, it is probable that sunlight activation can be practiced without the possibility of being stopped by the owner of some patent who seeks to monopolize the field.

Feeding of Irradiated Yeast to Cows

Early in this whole development, it was observed that when cows were fed viosterol or irradiated yeast, their milk became anti-rachitic, but unchanged in all other respects. The feeding of viosterol was found to be wasteful and expensive, whereas the feeding of irradiated yeast was more economical.

Dried irradiated yeast is now mixed with the grain ration of the cow and fed in the proportion of about one-half ounce of yeast per cow, depending on the milk production. In about two weeks' time, the vitamin D content of the milk reaches the desired level of 150 Steenbock units per quart. This procedure appeals to the sanitarian, the food control officer, and the certified milk industry, because it involves no manipulation of the milk nor the addition of substances foreign to regular milk. It is pure natural milk, just as the cow produced it. At the present time 188 licensees are using this method.

Attempts have been made⁽⁴⁾ to impart anti-rachitic properties to milk by directly irradiating the cow with ultraviolet light, but the results have not been satisfactory. No such milk is being marketed.

Summary

Milk whose vitamin D content has been increased by several different processes has been extensively tested clinically. Pediatricians who have worked with it agree that such milk is an important anti-rachitic food and that it has a unique place in the feeding of infants. Some evidence indicates that on account of the fact that such milk supplies calcium and phosphorus along with the vitamin, it may

also be considered a desirable food for adolescents and adults, particularly in the interest of an improved dental regimen.

Several processes have been developed for the successful production of vitamin D enriched milk. At present the most widely used of these is the direct irradiation of milk with ultraviolet light from a carbon arc lamp, but machines with mercury lamps are also in use and operate very satisfactorily.

Milk is also fortified with cod liver oil extract, and to a lesser extent with activated ergosterol. Other extracts are coming on the market.

The flavor of such enriched milk is not appreciably altered. These milks have in general received favorable acceptance by the medical profession and the public, and the indications are that they will find a definite and important place in our dietary.

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Discussion

Dr. E. V. McCollum (Baltimore): For a period of 30 years those of us who have been engaged in nutritional research have continuously progressed in a direction of simplifying the experimental diets in terms of chemical substances, and now we think we have an adequate diet in terms of something like 35 or 40 simple chemical substances. Among these is Vitamin D, which Dr. Shrader has discussed.

One of the puzzling phases of the disease known as rickets was that it was never found in the tropics, but always in the temperate zone. The facts now available show clearly that those who have absorbed a sufficient amount of sunshine containing ultraviolet rays of certain wavelengths on the skin obtain a sufficient amount of Vitamin D which is formed from a little ergosterol in the skin. The vitamin itself is picked up by the superficial capillaries and is transported throughout the body. Those in the far north who, over long periods in the year, had no sunlight, escaped rickets because they were taking a relatively large amount of foods of marine origin, oils from marine creatures which carried a large amount, as we now know, of this Vitamin D which is so indispensable for the stimulation of calcium and phosphorus.

In 1922 research was begun for the provision of cod liver oil to all infants. That reduced the incidence of rickets in America very gradually. At first, cod liver was the only known source of Vitamin D. Later on it was discovered that when food is exposed to ultraviolet rays, the food thereby acquires Vitamin D qualities. There is a little ergosterol, or some closely related substance, in nearly all of our natural foods. When the light shines on these they become vitaminized and in some way, at least, are capable of improving the metabolism of calcium and phosphorus. Most foods do not acquire a very high activity when they are irradiated.

I want to call your attention to the fact that milk may acquire on one irradiation with such methods as were described, about 50 so-called Steenbock's of Vitamin D per quart. Two or three Steenbock units are equivalent to an international unit.

Dr. Butler demonstrated that ergosterol, or even foods, spread out in the sunlight on a bright and clear day in Kansas or Indiana, much better in New Mexico, or in Arizona, or where the altitude is high and the atmosphere is clear, acquire certain anti-rachitic products. You can activate ergosterol readily on the beach at Miami, Florida. So that artificial sources of light while indispensable for the vitaminization of food are not all indispensable in the matter of a large

stock of the vitamin. Most of the ergosterol is now prepared from yeast. It is prepared in large quantities, activated, dissolved in the vegetable oil and then sold under the trade name of Viosterol. This activation can be done readily without any artificial source of light.

There are only two foods that are vitaminized, bread and milk. Children eat very little bread and adults drink very little milk, and if only one of those is to be vitaminized let it be milk. There was much talk of an overdosage. If you will search the literature dealing with this subject of pathological calcification, I assure you you will find that the cases reported in Europe are all cases where there was an overdosage of what is called vigantol, which was a German product, and ergosterol greatly over-irradiated. In those days they had not worked out the full particulars of doing this. There was no effort at purification of this over-irradiated ergosterol.

The result, we now know, is that the country obtained a large proportion of a very toxic product called toxisterol. It has been separated in crystallized form and the properties are known. In America and Europe when ergosterol is now activated by converting to Vitamin D, it is subsequently so treated by chemical process as to remove these toxic products.

Distinguished people all over the world in the last few years have battled with the problem of dental caries. Without exception they agree that a certain type of vitamin is essential to people. A diet in which there is a large proportion of milk, bread, leafy types of vegetables, moderate portions of meat, a fairly liberal amount of yellow vegetables, and the rest made up of whatever the diet calls for, given to children from infancy through adult life results in the formation of teeth which are free from pits and fissures in the enamel and therefore free from food scraps. The enamel is so perfect in finish and so smooth that the food does not tend to lodge there and they escape tooth decay.

Dr. Wm. T. Anderson, Jr., Ph.D. (Newark, N. J.): Our particular thanks are due to Dr. Shrader for his scientific presentation of the various methods available for the fortification of milk with vitamin D. Dr. Shrader has covered, as far as I am aware, all of the known methods which at present have any claim to consideration. Some of these methods have already found practical commercial application, and others, as he has indicated, are still in the experimental stage.

Dr. Shrader has referred to six years' experience with irradiated milk in Germany. It might be added that the first few years of milk irradiation in Germany was undertaken without the control of the Wisconsin Alumni Research Foundation whose German patent was delayed for a number of years. As a result the biological potency of the milk was controlled in a very hazardous manner, the milk was given a distasteful burnt flavor, and in some instances carbon dioxide was employed during the irradiation, imparting to the milk a soda water consistency. These factors greatly impaired the popularity of irradiated milk in Germany.

Fortunately, in the United States both the Committee on Foods of the American Medical Association and the Wisconsin Alumni Research Foundation have exercised control from the beginning and have been extremely careful to prevent impairment of the natural milk flavor and to certify by careful and frequent biological assays that a definite standard of vitamin D potency is maintained. In this they have had the wholehearted cooperation of the dairy industry and the equipment manufacturers who realize the necessity of offering the American public, milk of the highest quality.

The earliest commercial irradiation of milk in this country employed the quartz mercury arc as the source of ultraviolet light. The quartz mercury arc was selected because it was devoid of fumes, economical to operate, low in heat emission, very convenient to handle, and because, as shown by Coblenz, Dorcas and Hughes, Bureau of Standards Scientific Paper No. 539, the mercury arc emits a much higher percentage of its total radiation in the Ultraviolet 3200 Angstroms and shorter than do any of the other radiation sources investigated.

Initially the product resulting from this milk irradiation was excellent as to flavor and vitamin D potency. However, as a result of the non-existence of ultraviolet meters suitable for the measurement of the ultraviolet output of the lamps, and because of improper control of the lamp units, the employment of quartz mercury arc lamps for the fortification of milk with vitamin D was for a time discontinued.

Two subsequent developments in the Hanovia Research Laboratory have eliminated these earlier objections to the quartz mercury arc. The first of these, named after its inventor, Mr. Bird, one of our electrical engineers, relates to the electrical operation of the alternating electric current arc in a manner which provides for the operation of the quartz burner at much higher wattage inputs than were previously obtainable. There have resulted from this method of operation longer burner life, increased ultraviolet output efficiency, and a convenient and reliable means for the regulation of the ultraviolet output.

Much of the light loss from the quartz mercury arc results from a decreased transparency of the quartz glass to the ultraviolet radiations. These changes in the glass transparency are gradual, and, if the burner is not operating at peak wattage, may be fully compensated for by an increase in the quartz burner wattage by suitable increments.

The second Hanovia development has provided a recording ultraviolet meter which not only produces a written record of the ultraviolet intensity, but also in addition automatically controls the wattage to the quartz burner in such a manner that the ultraviolet emission from the lamp is maintained constant within very narrow limits. The meter also corrects for line voltage

fluctuations by automatically adjusting the burner wattage in the required direction. Wattage adjustment is made each half minute, if necessary.

Dr. Shrader has been carefully watching all developments in ultraviolet radiations and immediately recognized the importance of these Hanovia developments. He and his staff have collaborated with the Hanovia Laboratory in the development of the Hanovia-National Milk Irradiator. The Wisconsin Alumni Research Foundation has also given splendid cooperation in this work. The resulting Milk Irradiator, about which Dr. Shrader has told you, may be considered the result of highly cooperative research and engineering.

The Hanovia-National Milk Irradiator is a piece of automatic precision machinery which gives a positive written record of its action. The automatic controls are such that the written record gives a strict accounting of the performance. The record shows the time of day and the average linear intensity of ultraviolet on the milk irradiation surfaces. If the light is not falling upon the milk, or if the milk is not flowing properly, absolutely no record is made on the chart roll. Guesswork and the human element are completely eliminated.

So much of the successful operation of the Hanovia-National Milk Irradiator depends upon the proper functioning of the Hanovia Recording Ultraviolet Meter that it is not surprising that the question should be raised, how dependable is the ultraviolet meter? The Hanovia Recording Ultraviolet Meter is a product of the Hanovia Laboratory assisted by the research staffs of the Weston Electrical Instrument Company and Charles Engelhard, Inc. It consists of a light sensitive electronic cell permanently mounted and exposed to the light from the lamp. The cell is connected electrically to a Type S Recording Microammeter similar to those which have been standard equipment with the U. S. Weather Bureau for many years. The meters are calibrated by reference to similar instruments which have been calibrated at the National Bureau of Standards and furnished with their certificate. The Hanovia Ultraviolet Meter is a precision instrument, and since all such measuring instruments require occasional recalibration, the Hanovia staff have elected to recheck each meter after the first 150 hours usage and again after each additional 500 hours of use. With these precautions and this equipment, the user of the Hanovia-National Milk Irradiator has a complete guarantee that his milk is receiving the ultraviolet radiations and that these are constant in quality and quantity.

The Wisconsin Alumni Research Foundation has approved the use of the Hanovia-National Milk Irradiator by its licensees and the American Medical Association, Committee on Foods, is accepting Irradiated vitamin D Milk, which has been irradiated by the Hanovia-National Milk Irradiator.

PHYSICAL THERAPY FROM THE STANDPOINT OF THE INTERNIST *

THOMAS P. SPRUNT, M.D.

BALTIMORE

The ultimate goal of all medical practice is the successful treatment of the patient. We all realize this, but it is perhaps fair to say that scientific medicine in general is much more directly interested in the study of disease and in diagnosis with the ancillary subjects of pathology, of biochemistry, of radiography, etc. This is indicated by the content of scientific medical journals, by programs of society meetings, and by typical clinics of one hour's duration with perhaps the final five minutes allotted to a consideration of treatment. The reason for this is not far to seek. Therapeutic results in general are difficult of scientific demonstration. All good physicians recognize the great value of *vis medicatrix naturae* and remember in this connection the aphorism of Hippocrates that experience is fallacious and judgment difficult. We occupy, then, from a purely scientific standpoint a somewhat difficult position when dealing with a special method of therapy. Since we have no strong anchor and human nature being as it is, therapy by individual physicians and as applied by the profession as a whole often goes in waves or fads. How bizarre seem the therapeutic methods of a century ago! With the rise of scientific medicine before the advent of bacteriology, therapeutics suffered one of its major setbacks as illustrated by the self-confessed therapeutic nihilists of the Vienna school about the middle of the nineteenth century. Of them it has been said that they considered it satisfaction and glory enough for any patient to have had the clinical diagnosis made by Skoda and the confirmatory autopsy by Rokitsansky.

The rise of bacteriology brought to us vaccine therapy, serum therapy, antiseptic chemotherapy, and above all aseptic surgery, and who can say that true to form we have not overworked all these therapeutic procedures. With the growth of endocrinology we have seen the orgy of organotherapy with millions

of tablets and capsules that, with the exception of those containing thyroid, had not a kick in a carload. I may mention, too, the recent wave of interest in intravenous therapy when even the most readily soluble and diffusible substances like sodium iodide were put into the veins instead of into the stomach.

The layman is sometimes resentful of therapeutic methods and we are all familiar with the thesis that abuses of therapy or neglect of important features give origin to therapeutic fads and cults outside the regular profession. Homeopathy arose in protest against the polypharmacy of that day and is now happily reunited with us or almost so. The neglect of psychotherapy permitted the advent of Christian Science and other schools of faith healing, and our deficiencies in orthopedics and in physical therapy led to osteopathy. It is somewhat disconcerting that there still remains confusion in some medical minds as well as in those of the laity between rational psychotherapy and Christian Science on the one hand, and between rational physical therapy and cults like osteopathy on the other hand.

The Internist and Physical Therapy

Internal medicine covers a very broad field and it is a great task for internists to keep abreast of progress in all of its ramifications. Hence many sub-specialties are growing up within it. We have internists with special interest in cardiology, in tuberculosis, in allergic diseases, in gastroenterology, in nervous diseases, and the like. The internist's attitude toward physical therapy varies naturally with his special interest as well as with the breadth of his education and to some extent with his environment, including his geographic location and his contact with good physical therapy clinics. My own associations have been with a rather conservative medical community where changes occur slowly and where Tories rather than revolutionists abound.

Taking its literature as a criterion, if scientific medicine is little interested in therapy

* Read at the Thirteenth Annual Session of the American Congress of Physical Therapy, Philadelphia, September 10, 1934.

in general, it is definitely less so in physical therapy. Even the clinical journals with many articles on therapeutics devote but little space to physical methods of treatment. Similarly, in the annual meeting of that large representative body of internists, the American College of Physicians, this year, in four days there were in the general sessions but two papers on physical therapy.

With the exception of the treatment of arthritis and of the use of general massage for patients undergoing rest cure, it does not occur to many of my conservative friends to seek physical therapy for their patients. In conversation they confess some interest in the subject but not a great deal, and sometimes readily admit that the lack of interest has resulted in a dearth of detailed knowledge of the subject. Even we internists come under the general classification of Will Rogers when he said, "Everybody is ignorant, only on different subjects," and it seems probable that one of the subjects about which internists and general practitioners are ignorant is that of physical therapy. It is gratifying, however, that many of them seem quite willing to learn. There are those, too, whose ears are plugged with the cotton of prejudice and these will be harder to reach. There is even a tendency in some quarters to be critical of the literature and teachings of physical therapy with the statement that they are based largely upon wishful thinking and not upon conclusive demonstrations. Such critics, it seems to me, violate an old principle in permitting the pot to call the kettle black, for what branch of therapy is not honeycombed with autistic thinking! Nor is such a method of thought altogether deplorable for in this way there have arisen many useful procedures that are later found to have a sound basis. Nevertheless, realistic thinking, thorough demonstrations and multiple controls are excellent means for the convincing of skeptics and for laying firm foundations.

In the educational campaign to disseminate useful information, physical therapy is most fortunate in enjoying the support of the American Medical Association and of its Journal. The Council on Physical Therapy with its personnel of eminent men of thoughtful and conservative trend is instilling confidence into practitioners all over the country. We may profit, too, by following the lead of the Council in fostering a closer union with

the physiologist. There has been an unfortunate trend in this country in educating physiologists as doctors of philosophy instead of as doctors of medicine. A rift of this sort in the family may lead to a more definite separation unless we cultivate closer relations with this important member.

Reading the new physiology is not difficult. It may be found in most attractive form. For example, Professor Cannon has clearly and concisely outlined the marvelous biological mechanisms by which the fluid matrix of the body is preserved in healthful equilibrium and by which its remarkable reserve forces are mobilized and made available for extraordinary activities. The autonomic nervous system is among the most important mechanisms in the preservation of this homeostasis that Cannon has dubbed, "The Wisdom of the Body." The reading of his book with that philosophic title will prove a charming as well as instructive exercise for anyone interested in medicine. It has, by the way, been something of a surprise to me to note an apparent lack of interest among physical therapists in the autonomic nervous system which must be of great importance in the body's response to physical therapeutic procedures. That a closer accord with physiology is perhaps already under way is indicated by a fortuitous but pleasing observation that in the first volume of the *American Journal of Physiology* for 1934 there are 10 to 12 articles of direct interest to students of physical therapy.

Scope of Physical Therapy

The interested internist does not now believe that physical therapy is applicable to all internal diseases but it seems probable to him that the list of suitable ones will increase materially. There is great variation in the extent to which it is used in different cities. Taking all specialties into consideration, the director of physical therapy, department of hospitals, city of New York, in 1932, estimated that one of every six patients in the hospitals and dispensaries might be expected to receive physical therapy. I am sure that the proportion is very much smaller in Baltimore and in many other localities physical therapy exists only as an adjunct to orthopedics.

The internist may divide his treatment problems into different groups, as for example, (1) those in which physical therapy is essential,

still generally considered a small group; (2) those in which physical therapy may be helpful, quite a large group; and (3) those in which the use of physical therapy is based upon doubtful premises and is therefore highly controversial.

Of the first group, chronic arthritis with its kindred disturbances stands out conspicuously. In the deliberations of special groups for the study of arthritis on the continent of Europe, in Britain, and in this country, it is intriguing to note, on the one hand, the confusion and debate concerning the importance of focal infections, of vaccine therapy, or of dietotherapy, and on the other hand, the unanimity of opinion that at some stage of the disease physical therapy is essential. In the many types of neuro-muscular disorders where rehabilitation is practicable, physical therapy holds a commanding position.

It seems to me that it is in the second group in which physical therapy may serve as a more or less useful adjunct to other methods of treatment that we have the greatest promise of possible future benefit to internal medicine. In many chronic states the stimulating physical agencies may be used for their tonic effect, and there are favorable reports in increasing numbers of the use of physical agents in the treatment of acute conditions. Hydrotherapy has long been used in the management of acute febrile states. In my own personal experience of many years ago I remember well the relatively delightful feeling of the cold sponge during a malarial paroxysm. We note the widespread use of diathermy in the treatment of pneumonia for the relief of pain if for nothing else, the employment of the ultraviolet ray in erysipelas, and the more recent adaptation of the ultra short wave diathermy in the treatment of deep seated abscesses, even in the viscera and in the body cavities.

Short Wave Therapy

Certain European workers, notably, Schliephake and Liebesny, seem particularly optimistic in regard to the usefulness of these currents of very high frequency, even going so far as to attribute specific bactericidal effects to definite wave lengths. In the opinion of the *British Journal of Physical Medicine*, "It is no exaggeration to call short wave diathermy the greatest discovery in Physical Medicine since the work of Röntgen." The

internist may well rejoice in this discovery and look forward to the clarification of its therapeutic potentialities without accepting too precipitately the early reports of its bactericidal power. We are naturally interested in the possibility of deep heating effects upon the inner organs particularly in chronic states. Even with ordinary diathermy apparatus the effect upon the coronary circulation, upon that of the lungs, of the liver, and of the kidneys, does not yet to the unprejudiced observer seem satisfactorily determined. Certainly a recent report of the failure to find changes in renal function after only one hour of diathermy to the kidneys would not seem to be a satisfactory refutation of possible favorable effects of frequent treatment. And to cite as an argument against its usefulness the fact that no significant rise of temperature occurs in the lung with diathermy seems equally inadequate. Inasmuch as it is a function of the circulation to dissipate additional heat as promptly as possible, the matter resolves itself into whether this active local hyperemia is or is not useful in the treatment of the disease in question. Perhaps the use of the ultra short wave currents may aid in solving these hitherto difficult problems.

Fever therapy produced by physical agents is a matter of great interest to internists and will be studied by them with great care.

Probably the most intriguing and most useful of all the body's reactions to physical agents are those of the blood vessels. Their usefulness seems, however, to relate chiefly to local conditions and we wait hopefully for more satisfactory methods in the treatment of the early stage of arterial hypertension and of peripheral vascular disease.

Problems there are galore. For instance, is the physical therapy specialist also an internist? Does he conduct a diagnostic as well as therapeutic clinic? If not, who makes the diagnostic study? After all, it is the patient who should be treated rather than his disease. Not only should we know what disease this patient has, but also what kind of patient has this particular disease. These problems are more readily solved in large clinics than in private practice, and to raise the question at all is to quarrel with the whole existing setup of medical practice, and this is too large an order. Perhaps when we are all thoroughly regimented and told just what to do and when

to do it, these questions will be ironed out and there will exist no excuse for quarreling.

Conclusion

These fragmentary remarks of an internist looking at physical therapy may suggest to interested observers that physical therapy is rapidly increasing in usefulness and in prestige. Some observers fear that over-enthusiasm of some of its adherents may lead to unfortunate fads; but remembering again human nature and that even physical therapists are human beings, we may accept this as a fact with equanimity. The truth is mighty and will prevail; useful methods will survive and useless or pernicious ones will die a natural death in the course of time.

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Discussion

Dr. Heinrich Wolf (New York): It is an interesting experience that enthusiasm is generally in inverse proportion to scientific research. The less physicians knew about diagnosis the readier they were with prescriptions, the more physicians

were striving for an understanding of pathology the more did they neglect therapy. Outstanding diagnosticians are not necessarily great therapists, while excellent therapists are not always brilliant diagnosticians.

Dr. Sprunt has emphasized the difficulty of combining diagnosis with the practice of physical therapy. This is unquestionably the crux of the problem, particularly because we can say that conditions belonging to all other specialties at one time or another come within the sphere of physical therapy. The solution of the problem, however, is not difficult. It is not sufficiently appreciated by the rank and file that modern physical therapy methods are not and need not be practiced on an empirical basis. We know enough about the physiological action of these methods to determine with reasonable certainty the results of our treatments. A man who knows the physiological action and limitations of his methods can foretell with reasonable certainty the result of physical therapy procedures.

I should have liked Dr. Sprunt to mention the possibility of curing hitherto incurable diseases with hyperthermy. Physical therapy can favorably affect multiple sclerosis, gonorrhea in women, regardless of the *vis medicatrix naturae*. Of course, we know how complicated the factors often are that play a rôle in the pathological condition of the patient. The problem of the disturbances of the autonomic nervous system has such a protean character that neither the internist nor the physical therapist is on firm ground.

A great deal would be gained if the caste system which we condemn among the Hindus would be abolished among medical men. At present the surgeons and internists are considered to be on top of the ladder, with physical therapists being assured that they are medical men after all. The science of medicine today is so vast that no man can master even his own specialty. This should make us more tolerant and more cooperative. I believe that a physical therapist of a hospital should make rounds with the members of the staff. Here at the bedside of the patient a physician, familiar with physical therapy, would be able to make suggestions of value to the internist as well as to other specialists.

One must realize that the value of a man does not necessarily depend on the specialty he has chosen but on the person who has chosen it, and that by cooperation our professional problems will be solved with greater ease.

Dr. Thomas P. Sprunt (closing): I would agree with Dr. Wolf in deploring the existence in medicine of class distinctions between the different specialties. Any distinction should, of course, be based upon personal attainments and not on the specialty. I am distressed that anything that I may have said should suggest to anyone that such distinctions exist.

I have had in mind an exposition of internists' points of view in regard to the use of physical therapeutic measures and have directed attention to medicine's attitude toward therapy in general and physical therapy in particular.

PHYSICAL THERAPY IN PREVENTIVE MEDICINE *

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Physical medicine has maintained from the very earliest recorded time a high reputation for preventing illness. Even the most primitive of human beings have employed exercise in the form of sports, games, and swimming as well as the effects of heat and cold in the use of baths in natural water of rivers, seas and springs, in fresh air and sunshine, and in the steaming atmospheres of volcanic caves or fumaroles, in mud springs, and mineral springs for the purpose of fortifying the body against illness and toughening it against exposure and exhaustion.

Massage and manipulations have also enjoyed a wide use as a routine supplying measure, especially when applied in connection with baths, as well as to remove fatigue.

As soon as man could imitate nature by the discovery of electricity, radiant energy, and radioactivity, and by the production of radiation not found in nature, as x-rays, and the radiation used in broadcasting, he proceeded to make apparatus and machines whereby he could at will administer kinetic energy and in measured doses. Backed up by the resources of the clinical laboratory he now knows what his treatment is expected to do, what it does, and what are the results actually accomplished.

As a prophylactic, physical medicine plays both its oldest and newest rôle, since it repeats now with intelligent art what was formerly an empirical rule of thumb method. We will appropriately begin with prenatal prevention of disease, using the word disease in its widest sense.

We are sufficiently acquainted with the effects of photochemical rays in preventing infantile rickets when applied to the pregnant woman. We can however go back of conception. The coming generation inherits characteristics residing in the genes of its ancestors. If these genes tend to the production of idiots, imbeciles, morons, epileptics, diabetics, tuberculous, malignant growths, hemophilia or other conditions which render

the individual a burden to himself as well as to the community, aside from his potentialities as a criminal and the begetter of criminals, it is within the legal and moral right of a community to prevent their reproduction. Segregation is expensive though at times necessary when the individual cannot care for himself. Sterilization, already a legal procedure in some of our states and being considered abroad, is the rational preventive procedure. Two methods which are the least radical since they do not contemplate removal of the gonads, are vasectomy and salpingectomy or the sterilization by the electrochemical effects of x-radiation.

Where the mother is infected with a disease transmissible to her offspring both prior to and after conception, the child may be protected by curing the mother. Thus in the tuberculous parent natural and artificial heliotherapy are to be carefully administered in increasing doses for the purpose of enhancing the immunizing reaction, helping the utilization of calcium and phosphorous by the bones and muscles and cell nuclei, removing wastes by increased oxidation and thus preventing osteomalacia or puerperal fever and abortion. This also fortifies the child through the blood in utero and later through the mother's milk.

Fever heat cannot be maintained without danger of abortion and therefore fever therapy cannot be employed in syphilis of a pregnant woman. Local heat as in pneumonia of pregnancy may prevent abortion, and local heat to the genitalia for gonorrheal infection may prevent gonorrheal ophthalmia at birth.

As soon as the infant begins to exhibit active coordinated muscular movements it is time to employ graduated exposure to sun and wind in order to build up the immunity not only of the skin but also of the general constitution against infectious diseases.

The presence of adenoids and infected tonsils requires treatment by x-ray as indicated to prevent the serious consequences of mouth breathing on the one hand and septic absorption with rheumatism and heart disease, on the other.

* Read by title at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 11, 1933.

In the case of contacts or carriers of infectious respiratory diseases local treatment of the mucous membrane of nares, sinuses, pharynx, and mouth by photochemical and photothermal applications will help to sterilize the secretions and in conjunction with other recognized measures prevent transmission. With respiratory diseases there is great danger of extension to the eustachian tubes with otitis media, mastoiditis, and brain abscess or to the trachea with bronchopneumonia, pleurisy, and pulmonary abscess. This may be prevented if in addition to local sanitation to the nares and throat, converse heat, as from a photothermal lamp or from high frequency currents or fields, is continuously applied to the ears and to the chest, before symptoms are present.

My experience with a regiment of infantry arriving in the Philippine Islands with a large number of cases of measles among the new recruits is of especial interest. The treatment consisted in quarantine in a tent hospital, the use of an iodine-salt gargle and nose douche twice a day* and exposure to the tropical sun.

Out of about 300 odd cases there was only one with a complication of a mild otitis which did not require lancing. Scarlatina also has been found to be benefited by heliotherapy, as the rash is lessened and nephritis is believed to be less likely to occur. Smallpox eruption may be prevented from becoming confluent by using photothermal rays to the exclusion of photochemical rays. Scarring and general intoxication are lessened, so that in case of invasion of the eyes blindness may be averted.

Since fever therapy has been found efficacious in the neural complications of syphilis and local heat has sterilized the primary lesions, it would seem rational whenever syphilis is diagnosed to submit the patient to fever therapy to abort the disease before serious damage is done to vital organs, to say nothing of invalidism and expense.

In case of high blood pressure where apoplexy is an ever present menace, the reduction of blood pressure by autocondensation or the derivative effects of heat applied to the extremities by various means as foot bath, whirlpool bath, diathermy, phototherapy, etc., may lessen the cerebral capillary pressure and avert rupture. Gangrene of the extremities where threatened from diabetes, arterio-

sclerosis, thrombo-angiitis obliterans, or other vascular conditions where blood flow is slowed but not obstructed, may be averted by the application of diathermy or the whirlpool bath or other forms of penetrating heat, together with appropriate massage.

It is possible for bedridden patients and especially fever patients to develop a heat stroke when the weather is hot and humid for long periods, which condition may be overlooked. It is advisable under such conditions to keep the patients cool by means of cool water douches, sprays, or cold sponging, together with the movement of air by fans, since this is also a good tonic to the thermoimmunizing centers. Heat stroke may be thus avoided.

While every other tissue when inflamed is subjected to appropriate treatment the neurologists think that nervous tissue is sacrosanct and should be left unhelped until fate decides how much has succumbed and how much survived. I am not in sympathy with this do nothing policy, since this permits of the most serious destruction of vitally important nervous tissue as well as muscular paralysis and disturbance of vital vegetative functions.

Complications of acute infections of cerebrospinal tissue can be avoided if early antiphlogistic treatment is instituted. Thus diathermy, phototherapy, x-radiation may save some cells of the central nervous system in cerebrospinal meningitis, anterior as well as posterior poliomyelitis, syphilitic myelitis, and similar conditions before serious paralysis takes place. The absorption of clots after cerebral hemorrhage by electrolysis may prevent a permanent palsy.

In all injuries of the limbs which involve, or are near to joints, and which necessitate immobilization, treatment of the softer tissues, which have usually suffered as well as the bone or joint, must be started as soon as possible to prevent ankylosis. This is done by having the surgeon put on a removable splint or cast which is removed for the necessary treatment by massage, manipulation, and heat. The most efficacious and the least traumatic form of massage is that given by the surging positive high tension electric charge, called the Morton wave. Other electromechanical currents, as the sinusoidal and the surging sinusoidal, are used to prevent muscular wasting from disuse.

Glad Acres, So. Road.

* The Iodine — salt solution consisted of normal salt solution in any desired amount into which enough tincture of iodine is stirred to make the solution amber colored. The solution is used as hot as can be borne.

THE TREATMENT OF GENERAL PARESIS BY ELECTROPYREXIA *

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There have been many reports in the literature regarding the results obtained in the treatment of general paresis by diathermy, and in my paper in the *Archives* for August, 1933, I have discussed the results at the Illinois State Psychopathic Institute and the Elgin State Hospital which were secured by that agency. Recently we have abandoned diathermy for another method.

Before leaving the subject of diathermy I quote King and Cocke, who early reported on the advantages of that method over malaria therapy. In the following list we enumerate the chief advantages of this form of pyretotherapy: (1) It is always available. (2) No pathogenic organism of unknown effect is injected into the patient. (3) The frequency, duration and intensity of the febrile paroxysms are under accurate control. (4) The desired elevations can be produced in all cases, which is advantageous in cases that have an immunity to malaria. (5) Drug therapy can be used in conjunction with this form of pyretotherapy if desired. (6) Since the frequency, duration and intensity of the fever can be accurately controlled, the reaction produced in each patient can be more nearly standardized. This will enable us to learn the most favorable temperature curve.

Our objections to the use of diathermy are: first, nervously inclined patients are difficult subjects for treatment; second, individuals markedly disturbed are unsatisfactory patients; third, the expense of the original investment makes it unavailable for use in certain localities; and fourth, the danger of burns.

Radiotherapy

Radiotherapy has been used to treat patients afflicted with general paresis, and I shall describe the apparatus as I saw it in use at the New York State Psychiatric Institute, as reported by Hinsie and Blalock in the *Psychiatric Quarterly*.

The equipment was constructed on the same principle as a short wave radio transmitter, with the exception that the energy is concentrated between two condenser plates instead of being directed from an aerial. The patient is suspend-

ed on interlaced cotton tapes stretched across a wooden frame, the under surface of which is covered with celotex forming an air chamber beneath the body. The patient rests on his back and the plates are placed at each side of a celotex box, so that the waves oscillate through the body from one side to the other. Ordinarily the patient is not kept in the radiotherm after the desired temperature has been reached. The temperature is maintained for six or seven hours more by the following measures: when the patient is taken from the radiotherm, he is immediately wrapped in four woolen blankets and taken to his bed, which has been prepared by warming to receive him. The patient lies on a rubber sheet under which is a fifth woolen blanket. Both the sheet and the additional woolen blanket are placed completely around the patient. Four or five hot water bottles are then placed around him. The object of all this is to prevent heat loss. Additional blankets may be used if necessary.

The technic of treatment of these patients was essentially that observed in malarial hyperpyrexia, in which treatment approximately 70 hours of temperature above 102 degrees F. were divided into ten parts. The Wassermann reactions, both of the blood and of the spinal fluid, and the colloidal gold curves were not as much reduced under radiotherm therapy as they are under malarial therapy. The conclusion, namely, that the clinical improvement of 53 per cent is equal to that obtained with malaria, is drawn from a group of 68 patients treated during a period of 19 months (June, 1930, to November, 1931), and surveyed approximately six months after the completion of treatment. Care must be taken against electrical burns, for they are stubborn to heal and when they occur treatment is necessarily delayed. They occur with sufficient frequency to keep one on constant guard against their appearance. They appear, it seems, principally during restlessness of the patient. They are more likely to happen when the patient is passing through the phase of restlessness that is commonly observed when the temperature is around 102 to 103 degrees F. It appears that by radiotherapy the patients are subjected to far less severe strain than are those who undergo malarial therapy.

We have had no experience with this form of treatment.

Electric Cabinet

The Electric Cabinet has been in use for some time at the Kankakee State Hospital and the physicians there have kindly consent-

* Read at the Twelfth Annual Session of the American Congress of Physical Therapy, Chicago, September 14, 1933.

ed to permit the following report of their experiences. Doctors Hoverson, Morrow and Hawthorne have reported in the *Illinois Medical Journal* for March, 1933, and also further reported to me by personal communication as of August, 1933. They proceed as follows:

The cabinet was fabricated and constructed in the sheet metal department of the hospital at a cost of about \$35. The cabinet is constructed of 24 gauge galvanized iron. The center inside height is 24 inches, and the sides are vertical for a height of 14 inches, and then curved gradually to the center. One end of the cabinet is closed by a galvanized iron section "double-sealed" to the main body of the cabinet. Wires insulated by asbestos are placed in the grooved ribs and lead to electric sockets which are located on the sides of each rib. Four such sockets are on each side of the ribs, giving a total of eight lights per rib and a total of 24 lights. The lights are placed in a series of 12 each, which permit the use of a greater amount of heat in producing the desired temperature, and of a lesser amount of heat, to maintain a given temperature with comfort to the patient. The current used is a 220 D. C. The bulbs are each of 30 watts and are shielded by a heavy wire netting attached to the frame and wooden rib. The lights are controlled by two switches on the outside of the cabinet, one for each series of lights. The bed is prepared by first placing a rubber sheet on the mattress, and over this is laid a cotton sheet. The patient is unclothed and covered with a cotton sheet which is placed on the bed. The cabinet is put in position over him and a blanket is draped over the open end around the patient's neck. Then several thicknesses of woolen blankets are laid over the cabinet. The 24 lights are turned on and remain burning until the patient's temperature has reached 104 degrees F. Then only 12 lights are used until a temperature of 105 degrees F. has been attained. All the lights are then turned off. A temperature of 105.5 degrees F. is usually obtained in two hours, and the temperature usually rises to 106 degrees F. and remains at this level for about one hour. When the temperature begins to drop from 104.5 degrees F., the 12 lights are turned on and kept on until the temperature again starts to rise. Their procedure has been to keep the temperature over 105 degrees and under 106 degrees F. for three to five hours. At first the patients were placed unclothed in the cabinet, without a sheet between them and the lights. In these cases a loss of weight of five pounds was not uncommon. When a sheet was placed over the patient, the usual loss of weight was about one pound. This loss was regained the following day. In all cases the patient was urged to drink water. Sometimes as much as six liters was consumed. The average of about three liters was consumed as a rule.

Hoverson, Morrow and Hawthorne in their personal communication of August, 1933, shows the following results:

Up to the present time, there has been a total of 47 patients treated by this method. No one of the 47 has received more than 30 nor less than 12 treatments, and all courses of fever therapy have been followed by a series of ten tryparsamide injections. The number of fever treatments is determined by the patient's response. When it is believed that the patient has shown the maximum improvement, fever therapy is stopped, if 12 or more treatments have been given and tryparsamide injections started. All patients considered improved sufficiently to warrant their release, are presented to the entire medical staff, and their releases considered. Hence, the release of a patient is based upon the opinion of the entire medical staff. Of the 47 patients, one died in the course of the disease, 14 have been discharged from the institution as recovered, and an additional four are now awaiting arrangements for their release. Thus, 18 of the 47 have been recommended for discharge by the medical staff. No patient who has been represented has been found not fit for discharge. Of the remaining 28 patients, 11 have shown marked improvement and apparently are fit to be discharged. They will be considered for release as soon as they have completed their courses of tryparsamide injections. Thus, 29 patients have shown marked improvement, one has died, and 17 have shown little or no improvement.

At Elgin we have had no experience with the Electric Cabinet.

Electric Blanket

The Electric Blanket has been in use at Elgin for four years, and we feel that it is the simplest and safest form of fever producing agents. We believe that an acceptable theory of the mechanism of this form of treatment is, that the fever brings about some change in the spirochetes and organically also in the endothelial system of the host. The blanket is about six feet square, and by a connecting cord is simply plugged into an electric socket. The patient is wrapped in blankets, over which is placed the electrically heated blanket.

In treating patients, use is made of an ordinary alternating current, which is introduced for one hour, off for 10 minutes for each hour of use, then turned on again. The temperature rises to 103.6 degrees F. in one and one-half hours; then the current is shut off and the temperature of the patient rises to 105 degrees in 15 minutes, then to 105.6 in another 15 minutes. The blanket is now removed and the temperature of the patient remains at 105 for an hour and a half, after which it returns to normal in about two hours. After a cold sponge and a little sleep the patient is ready to go about with no ill effects

whatever. Approximately 75 per cent of the patients have shown some degree of improvement under this treatment, and about one-third have developed such well-marked remissions that they are classed among the best workers in the institution. Some of the improvements have been startling; as, for instance, the case of a bed-ridden individual, apparently deeply demented, who, on the completion of the course, had so far improved that he became a good worker and had parole of the grounds.

The practical question of how many have been improved to the extent of ability to return home and to renew their occupations is as yet unsettled because of the industrial depression. Survey of those in remission serves to make us expect an ultimate discharge rate of about the same as that of von Jauregg, namely, 20 per cent. If our experience follows that of von Jauregg this 20 per cent will never again have to enter an institution. Perhaps in time we can do better than this, but it is believed this will come only when the general practitioner and the public learn the importance of starting this form of treatment before mental deterioration has begun. Eighty per cent of our patients seem to come to us only after brain cell destruction has progressed to such a serious degree that even though the disease be checked, it is still impossible to re-socialize them. There are no dangers with this form of treatment, and we reject only those patients who are in an advanced stage of physical or mental deterioration.

A survey was recently made at the Illinois State Psychopathic Institute and the Elgin State Hospital of 230 patients treated by the Electric Blanket over a three-year period, from 1930 to 1933. During the treatments each patient lost about five pounds in weight, but the loss was generally made up before the next treatment. Observing the weights throughout we found that 45 per cent of the patients gained, 31 per cent remained stationary, and 24 per cent lost slightly.

Regarding the neurological changes, speech was improved in 18 per cent and the gait in eight per cent. There was little alteration in the other neurological signs, the ocular findings and reflexes remaining unchanged.

The mental symptoms improved in all of the discharged and improved patients, and became worse in those who were gradually deteriorating in spite of the treatments, the lat-

ter group constituting seven per cent of the total.

The serological findings were as follows: The Wassermann and Kahn tests of the blood were reduced in strength in only six of the 230 patients. The Wassermann and Kahn tests on the spinal fluid remained the same in all of the cases. The cell counts in the spinal fluid often showed marked improvement almost at once in 86 per cent. In 26 per cent a high cell count was reduced to normal at the end of the treatments. In all cases in which globulin was present before treatment, it persisted, but there was marked reduction in the degree of positiveness in 72 per cent. A marked improvement was noted in the colloidal gold test, the paretic curve changing to the luetic curve in 32 per cent, and flattening down in 26 per cent of the cases. Regarding the permeability quotient, there was 71 per cent of the patients who had increased permeability for the bromides before the treatments. This permeability decreased, i. e., returned toward normal in 83 per cent, who showed clinical improvement.

Of the 230 patients treated, 72 per cent were definitely improved, 10 per cent remained stationary, seven per cent have deteriorated, and 11 per cent have died. Of the improved patients, 30 per cent were discharged by the Elgin Hospital, and 14 per cent are now on parole.

During this three-year period, a total of 635 paretics were admitted to the Elgin State Hospital. Of this grand total, 44 per cent are now present, 31 per cent have died, and 25 per cent have been discharged as improved, following parole.

Conclusion *

The interest in hyperpyrexia has been greatly stimulated by the work in various clinics, and all methods seem to have shown various degrees of improvement. We hope that education of the laity and the profession will lead to earlier treatment, and that further research by various investigators will produce even more favorable results in patients afflicted with general paresis.

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The Editor, the Editorial Board and the Officers of the
Congress extend

Season's Greetings

and sincerely wish the fellows of the Congress and the
subscribers to the Archives

A Merry Christmas

and a

Very Happy New Year

VALUE OF THE ELECTROCARDIOGRAPH IN CARDIAC DISEASE *

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It is scarcely 30 years since Einthoven invented the string galvanometer, an instrument capable of measuring the minute currents produced by the contractions of the heart. The modern electrocardiograph is now essential for a complete cardiac examination.

I will first speak briefly of the normal electrocardiogram. Currents produced by the heart are gathered by means of electrodes placed on the arms and left leg. The currents are recorded between the right arm and left arm (Lead I); between the right arm and left leg (Lead II); and between the left arm and left leg (Lead III). The string galvanometer moves when the various parts of the heart contract. These movements appear as waves or spike-like deflections on the graph. The various parts of the heart produce characteristic waves. Each horizontal millimeter represents 0.04 second and each vertical millimeter represents 0.1 millivolt on the electrocardiogram. The auricular contraction or P wave is a small rounded curve 0.1 to 0.2 millivolt in height and from 0.6 to 0.10 second in duration. It is followed by an interval of no movement of the galvanometer representing the time necessary for the impulse to travel from the auricle to the ventricle. This interval normally lasts for 0.06 to .14 second. A series of spike-like deflections called the QRS complex follows, lasting from 0.06 to 0.10 second and representing the spread of the impulse through the intraventricular septum and ventricular muscle. The Q wave is small or absent and goes below the baseline. The R wave is from 0.6 to 2.4 millivolts in height and goes above the baseline. The S wave is of variable size and goes below the baseline. Following another quiet interval comes the T wave which probably represents the recession of the ventricular contraction. It is a peaked upright wave varying from .2 to .8 millivolts in height and from .10 to .20 second in duration. Alterations in the char-

acter or sequence of the waves constitute a pathologic electrocardiogram.

Irregularities of the Heart

There are many different kinds of irregularities of the heart. Respiratory sinus arrhythmia is a frequent irregularity in which the heart rate is increased during inspiration and decreased during expiration. It occurs in normal hearts especially in children. It is a physiological arrhythmia and is due to changes in the tone of the vagus. Exercise generally abolishes sinus arrhythmia. Occasionally this irregularity is so exaggerated as to simulate auricular fibrillation or partial heart block. In the electrocardiogram the P, QRS and T waves are normal and retain a constant relationship to each other.

Auricular fibrillation is a far more serious irregularity. Rapid irregular contraction waves circulating in a haphazard manner replace the regular contractions of the auricle. The ventricles respond irregularly also, their rate being from 60 to 200 contractions per minute. Auricular fibrillation occurs in many different cardiac conditions, including chronic rheumatic heart disease, generally with decompensation, hyperthyroidism, syphilis, pneumonia, and coronary thrombosis. The electrocardiogram shows small rapid irregular "f" waves appearing between irregularly spaced ventricular complexes.

Auricular flutter is much like auricular fibrillation although it does not occur as frequently. Most cases of flutter fibrillate eventually if the irregularity continues. The contraction waves in auricular flutter are very rapid, but are regular and originate from a ring of auricular muscle. The wave spreads from this ring through the rest of the auricle and into the ventricles. The rate of auricular contraction is usually about 300 per minute. The ventricles contract regularly to every second, third, or fourth beat of the auricle. Auricular flutter occurs in the same diseases as does auricular fibrillation. One cannot make a diagnosis of auricular flutter except

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with an electrocardiogram or polygram. In the electrocardiogram of auricular flutter one sees small, rapid, rhythmic waves between the ventricular complexes.

Extrasystoles or premature contractions frequently cause an irregularity of the heart. They are divided into auricular, nodal, and ventricular extrasystoles as determined by electrocardiogram. Although extrasystoles are considered harmless in themselves, the patient should be given the benefit of a thorough heart examination since they may be the only sign of serious heart disease. They are found more frequently as age advances. They appear in diseases which affect the myocardium. Auricular and nodal extrasystoles are often found in apparently normal hearts. In many cases they seem to depend on psychic disturbances. Auricular extrasystoles occurring frequently in cases of mitral stenosis are considered by East and Bain⁽¹⁾ to be warning signs of impending auricular fibrillation and decompensation. In cases of aortic valvular disease or in hypertension frequent ventricular extrasystoles indicate a pathologic condition of the left ventricle. Drugs, tea, coffee, tobacco, and alcohol frequently initiate extrasystoles. In the electrocardiogram auricular extrasystoles are recognized by (a) the premature appearance of the P wave, (b) the abnormal shape of the P wave, and (c) the normal appearance of the QRS and T waves. Nodal extrasystoles which arise in the septal tissue are like auricular extrasystoles except that, if the P wave appears at all, it comes after the QRS waves. Ventricular extrasystoles have no P wave, the QRS is abnormally wide and slurred, and the T wave is in the opposite direction from the QRS. At present there is some dispute as to the origin of the different types of ventricular extrasystoles.

Paroxysmal tachycardia is the sudden acceleration of the heart rate due to a rapid succession of premature beats. The various types of paroxysmal tachycardia are auricular, nodal, and ventricular similar to extrasystoles. Paroxysmal auricular tachycardia occurs more frequently in apparently normal hearts than does paroxysmal ventricular tachycardia. Strauss⁽²⁾ found cardiac disease in four-fifths of his cases of ventricular tachycardia. An electrocardiogram is necessary to differentiate paroxysmal tachycardia from the

simple tachycardia or from auricular flutter and fibrillation.

Heart block is an irregularity of great clinical significance. There are two types, partial and complete. Partial heart block is due to the failure of part of the impulses from the auricle to reach the ventricles. Sometimes the ventricles contract after every second, third, or fourth beat. This is known as 2:1, 3:1, or 4:1 block. Complete heart block is due to a total failure of the impulses from the auricle to reach the ventricles. The ventricles set up a contraction rhythm of their own, generally very slow. Heart block may be associated with a variety of clinical conditions. A transitory partial heart block indicates an acute heart lesion or poisoning. It is one of the few reliable signs of early rheumatic heart disease. In outstanding cases of heart block the Stokes-Adams syndrome may appear. Any rate under 35 beats per minute is almost invariably due to complete heart block. In partial heart block the electrocardiogram shows a gradual lengthening of the P-R interval until finally a P wave appears which is not followed by the ventricular complex. The next P-R interval is of shorter duration but the ones following are increasingly longer. Sometimes one sees a prolonged P-R interval that remains constant with no dropped beats. Partial heart block may develop later in these cases. In complete heart block the P waves appear at regular intervals, generally 60 or more per minute, while the QRS and T waves have an unrelated rhythm, usually 35 or less per minute.

During the routine examination of patients with or without cardiac symptoms one sees not infrequently a pronounced widening or slurring of the QRS complex. The T wave follows immediately instead of a pause intervening. These findings are known as bundle branch block and are due to an injury of one of the branches of the tissue that conducts the contraction impulse from the auricle to the ventricles. Bundle branch block is associated with myocarditis of acute rheumatic fever, acute infections, lues, sclerosis of the coronaries and coronary thrombosis. It always indicates an involvement of the myocardium, either acute or chronic. The death rate in patients with bundle branch block is unusually high. The electrocardiogram may be the sole evidence of cardiac disease in bundle branch block.

Coronary Thrombosis

The electrocardiogram is often of extreme value in cases of coronary thrombosis where the diagnosis is not obvious from physical examination. In tracings taken shortly after the attack, the T wave in one or more leads swings off directly from the R or S wave instead of returning to the baseline. After a period of days to weeks the T wave comes off nearer the baseline and gradually becomes inverted. The inverted T wave is rounded and crescent shaped. Later the T wave may become upright again, apparently coincidental with repair and resumption of the normal contraction process in the ventricles. When one finds this series of changes taking place in an electrocardiogram one can be sure that there has been a coronary thrombosis. If a tracing is taken some time after an attack one may see only an inversion of the T wave. In some cases of coronary thrombosis one may find only irregularities in the electrocardiogram, including extrasystoles, heart block, auricular fibrillation or flutter. One may see a prolongation of the QRS complex, a very low excursion of the QRS and T complexes or a bundle branch block. If any of these findings are seen in a patient over forty years of age with a suspicious history, one must always strongly consider coronary thrombosis.

It has been noted that an increase in the height of the T wave occurs in hyperthyroidism. Hamburger⁽³⁾ found that the T wave decreases in size following iodine therapy and thyroidectomy. Zondek⁽⁴⁾ and others have reported signs of cardiac failure associated with myxedema. In the electrocardiogram the P and T waves are small or inverted. These waves become normal and the cardiac failure disappears with thyroid therapy.

It has been found that a change in the direction of the major initial deflection of the QRS waves is associated with a greater hypertrophy of one of the ventricles than that of the other. This is only true when it is known from other evidence that the heart is enlarged. The electrocardiogram may show the same changes when there has been an anatomic shifting of the heart, changing its electrical axis. Short, fat men with transverse hearts frequently have this type of electrocardiogram. The QRS in Lead I is upright and in Lead III inverted in preponderance of the left ventricle. The QRS

in Lead I is inverted and in Lead III upright in preponderance of the right ventricle. Left ventricular preponderance is seen in lesions of the aortic valve, hypertension and hyperthyroidism. Right ventricular preponderance is seen in cases of mitral stenosis, most congenital lesions, and sclerotic changes in the pulmonary arteries. With the electrocardiogram one can differentiate congenital from acquired dextrocardia. In congenital dextrocardia all of the waves in Lead I are inverted, while Leads II and III are transposed. In acquired dextrocardia the electrocardiogram is normal or shows only a shifting of the electrical axis. It is possible to make a diagnosis of myocardial involvement from the electrocardiogram. The findings are: a slurring or notching of the QRS in two leads, inverted or diphasic T in one or more leads exclusive of Lead III (normal hearts show an inversion of the T wave in Lead III in about 25 per cent of the cases), low excursions of the QRS or T waves in all leads, and a Q wave in Lead III that is greater than 25 per cent of the highest R excursion.

Discussion

The electrocardiograph is not without limitations. A normal electrocardiogram does not necessarily mean a normal heart. Myocardial involvement should be interpreted as myocardial damage only in conjunction with the clinical picture. The amount of myocardial involvement may not correspond to what is seen in the electrocardiogram. Often one cannot determine from the electrocardiogram whether the involvement is acute or chronic. Physiologic changes can easily be confused with minor changes in the QRS and T waves. Digitalis can produce changes in the QRS and especially in the T wave which can be mistaken for myocardial involvement. It is not possible to make a diagnosis of valvular disease from the electrocardiogram. It is, as all other mechanical means in medicine, only an aid in diagnosis.

Nevertheless, it is invaluable in many cases. Bacon, Kretschmer and Woodruff⁽⁵⁾ took routine electrocardiograms of patients with prostatic obstruction. They conclude that "in certain elderly individuals whose hearts are reported as normal to physical examination by the internist, the electrocardiogram may show definite evidence of myocardial disease, a fact that should warn the surgeons of the possible

danger in attempting an operation, particularly under general anesthesia."

There is a decided practical advantage in differentiating the irregularities of the heart. The prognosis of extrasystoles, as a rule, is much better than that of auricular fibrillation. Extrasystoles from one focus are less dangerous than those from several foci. Auricular fibrillation is a serious heart condition, while sinus arrhythmia is a physiologic variation. To give digitalis or quinidin to a patient with partial heart block is dangerous, but is good treatment in auricular fibrillation. The simple tachycardias have a better outlook than the paroxysmal ones. Quinidin is not indicated in the simple tachycardias, but may be in the paroxysmal tachycardias. The outlook in a sinus bradycardia is obviously much better than in partial or complete heart block. An electrocardiogram may be of value after thyroidectomy in differentiating hyperthyroidism from myxedema.

Finally, in the treatment of heart cases the electrocardiogram is essential. I have indicated what can be learned from repeated electrocardiograms in cases of coronary thrombosis. The electrocardiogram is a valuable guide in digitalization. The appearance of an inverted T wave, extrasystoles or a partial heart block indicates that a digitalis effect is being obtained. The electrocardiogram also serves as a good guide in preventing overdosage of such drugs as digitalis and quinidin.

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Discussion

Dr. Harry J. Isaacs (Chicago): Electrocardiography plays an important rôle not only from a diagnostic but also from a prognostic viewpoint, and from the standpoint of therapy it should be thoroughly investigated. Primarily we should attempt to make a correct diagnosis by clinical judgment and examination and should only use the electrocardiogram to substantiate or to show where we have made a mistake in the diagnosis.

As Dr. Cooley has so well demonstrated, a

left axis deviation simply signifies hypertrophy of the left ventricle. The same thing is true when a right axis deviation presents itself. It shows the clinician that his patient has a congenital heart or rheumatic heart, or mitral stenosis, and from such findings we can determine or obtain a good deal of information.

In a case of rheumatic heart, particularly in young children, we advise routine electrocardiographic tracings to see whether there is any cardiac damage. If the P-R interval is over the normal length of .2 seconds, or there is some other abnormality, rheumatic heart systole is indicated and it should be treated as such, even though cardiac murmurs and other symptoms of heart failure are present.

In coronary disease, with symptoms of nausea, jaundice, Liebisich cyanosis, pressure in the chest, the surgeon's diagnosis of the coronary syndrome may be clinched by taking an electrocardiographic tracing. Coronary disease may not show itself in the first three leads, but the fourth lead tracing brings out the definite coronary syndrome.

A typical application of the electrocardiogram from a practical standpoint was demonstrated to me three or four days ago. A patient came in with cardiac failure and the case was diagnosed as hypertension of the heart systole. There was also a history of high blood pressure, heart enlargement, systolic murmurs, and swollen liver. The next day the nurse reported that the patient had had a fainting spell, fallen on the floor, and injured his head. The question therefore arose whether we were dealing with a cerebral accident, whether an embolic process does not occur in hypertension heart systoles, or an auricular heart, or sometimes in coronary thrombosis, or whether the cerebral accident might have been the result of some other cardiac disease, like heart block. An electrocardiographic tracing taken that day demonstrated that in addition to his hypertension heart systoles, the patient also had complete heart block. That is one practical clinical application of the use of electrocardiography as we see it from the clinical viewpoint.

From the therapeutic viewpoint we can determine whether or not we shall use the toxic effects of our drugs, digitalis, which is the drug used routinely in most institutes. If we find developed multiple extrasystoles, coming from various foci of the heart, or if we find the P-R interval increased over .2 per cent, that will usually tell if we are dealing with the toxic effects of the drug, digitalis, and thus we can simply eliminate the drug. I may say that clinically we usually do not wait for such toxic demonstrations. If the patient states that he has lost his appetite under the use of digitalis, irrespective of pulse rate and irregularities, or however it may demonstrate itself, clinically or electrocardiographically, we stop our medication, because digitalis intoxication is always indicated by loss of appetite. Patients often possess enormous appetites but lose this after taking digitalis for a while.

I believe we should routinely electrocardiograph all cardiac conditions, but should not use

it for the final test because we should learn to rely on our clinical senses and judgment first and try to arrive at a definite diagnosis before we employ the electrocardiogram.

Dr. Louis F. Bishop (New York): I want to advocate that the electrocardiogram be made a routine part of the examination of every medical case, because the electrocardiogram is individualistic. The electrocardiogram of the individual is as individualistic as the nose or ears of his face or any other part of his body. It differs in every individual from every other individual. In other words, it is personally characteristic of the individual, and just as the doctor treating a skin disease would like to have the history or picture of the patient before he developed the skin lesion, to compare the pathology, so it is of tremendous advantage to have a normal electrocardiogram on record to compare with the electrocardiogram when something happens.

During the 20 years I have been a student of electrocardiography, I have accumulated, of course, a vast number of electrocardiograms that did not show anything at the time, but during those twenty years these same people have developed every kind of lesion. I have a large collection of electrocardiograms of patients now suffering from coronary thrombosis. I also possess their normal electrocardiogram taken five, ten, or fifteen years ago, and I have found it of great advantage to have these normal tracings as a comparison so that I think the electrocardiogram ought to be a routine part of every physical examination as a permanent and comparative record.

Electrocardiography, of course, is only one part of our diagnostic procedures, hence we must not neglect the complete examination of every patient. The patient's history is extremely important, as is also the history of how he responds to effort. The fluoroscope, x-ray, and other diagnostic agents are just as important as the electrocardiogram. It is not fair to send a patient to a doctor and say, "Take an electrocardiogram and tell me what is the matter with this patient." The electrocardiographer needs the whole clinical picture of the case in order to draw his conclusions, because there can be all kinds of anomalies.

In regard to variations of the electrocardiogram from things happening in the stomach and intestines, and so on, we have learned to discard as a matter of routine the usual results in one base line. We usually discard those parts of electrocardiograms where the base line is one on account of the movement of the patient, or some similar phenomena, but nevertheless it is interesting to have these pictures showing hyperperistalsis.

Dr. Louis N. Katz (Chicago): For those who are not experts in this field of electrocardiography it is practical to re-emphasize a few facts. The electrocardiogram is a record of the electricity created by the heart during each heart beat. It has three essential waves: 1. The B wave associated with the spread of the impulse in the auricles. 2. The QRS wave, associated with the spread of the impulse in the ventricles. 3. The

T wave, associated with the recession of activity.

There is nothing in the electrocardiogram that gives one an idea of the mechanical force of the heart. Those who try to determine the mechanical force of the heart from the electrocardiogram delude themselves. The electrocardiogram is primarily of value in checking arrhythmias, but as Dr. Isaacs emphasized, besides using this specialized equipment we should train ourselves to make diagnoses at the bedside. We still perform autopsies, and the electrocardiogram, if you will, is a sort of living autopsy.

In the second place, the electrocardiogram is very valuable in checking the management of clinical progress.

In the third place, the electrocardiogram is very valuable in diagnosing certain types of heart damage. It does not tell you about all sorts of heart damage. It may be silent when there is tremendous damage. It may show vast changes when there are only slight changes so far as the patient is concerned. It is of prime importance, and becomes almost court room evidence in coronary occlusion, a condition which takes greater toll of professional and wealthy people than any other single disease.

The electrocardiogram, therefore, really has a very important place, and since the introduction by Woodruff and Wood in Philadelphia of this trans-chest lead which we have been able to follow at Michael Reese Hospital, we have as yet in 36 cases, and 55 recently assembled in Philadelphia, to see a clinically diagnosed, and a few of them autopsy checked, case of recent coronary occlusion that the electrocardiogram can't pick up. That, it seems to me, is the sort of thing the people who are not specialists in this field would like to know.

I think Dr. Tumpeer's paper is very important for two reasons. In the first place, it shows that the patient who is very quiet may show movements of the string to a tremendous degree because his intestines are over-active, and that leads to the point that for the first time as far as I know, and Dr. Tumpeer has investigated the literature quite thoroughly, a method is available which might be developed of determining the electrical activity of the intestinal tract in a person who hasn't a stomach tube in him or some other gadget that disturbs the equilibrium. In other words, if this method is developed at all, it has promise perhaps, if we let our imagination roam at all, of developing analysis of the gut; perhaps as much as the electrocardiogram has done in developing the knowledge of the heart.

Dr. Laurence E. Cooley (closing): I have nothing to add except that the point made by Dr. Bishop of routine electrocardiograms is very valuable. I have a number of tracings of patients in whom I would like to have had a tracing of fifteen years ago when they had what is considered a normal heart. We see small changes in the T wave of the QRS wave which we sometimes are hesitant to interpret as a myocardial damage, but if we had a former tracing, it would give us important comparisons.

TREATMENT OF HEMIPLEGIA *

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This presentation can be considered as little more than a preliminary report of work begun in the department of physical medicine of the Protestant Episcopal Hospital, continued with the cooperation of the neurological section and more recently supplemented by animal experimental investigation with Dr. McGlone of the department of physiology, of the University of Pennsylvania. A few cases have also been included from the department of physical medicine in the Abington Memorial Hospital.

The physical therapeutic measures in the treatment of hemiplegic and other chronic diseases of the nervous system have been largely directed to that part of the body wherein function has been disturbed. Little effort has been made to alter the pathologic lesion in the brain. The literature was scanned for help and little became available, as diathermy to the brain was considered risky and to be avoided.

The good results obtained from diathermy to other parts of the body prompted us to study its effect upon the brain. Improved circulation is decidedly an asset in any organ where the circulation is sluggish with part of the capillary circulation more or less dormant. Therefore, we began these observations in a hope of bringing about a more effective circulation in the area of brain destruction. We did not expect to restore function to areas of softened brain where disintegration was complete, but by improved circulation we thought it possible to lessen the symptoms which may result from the area of reaction surrounding the softened tissue.

The usual procedures of passive and active movements, massage, re-education of muscles, baking, and stretching of the affected extremity procured the usual results after months of treatment. By no conception can these measures alter an existing brain lesion. The object of this study was to attempt to influence the brain lesion by passing the diathermy current through the head.

Because of the ease with which they were obtained, our studies were first instituted on a group of six hemiplegic patients who were suffering from thrombotic lesions. It happened that these hemiplegics have had their lesions from one to two years, and that there was little hope that their disability could be definitely influenced. They showed typical spastic hemiplegia, one patient having a complete motor aphasia, and the others having various gradations of speech impediment. Destruction of brain cells had already occurred and restoration of function could not be re-established. The group of patients were cooperative and have lent themselves admirably to this study. While many of the patients state that their hemiparetic extremities feel stronger, more limber and relaxed, and that associated dysesthesias have improved or disappeared, and even though their friends and members of the patient's family felt that the patients had improved, there has been little objective change in their status. We believe that if these patients had been treated earlier, before extensive brain destruction had occurred, it may be probable that the brain function could have been preserved to a greater degree.

Metal electrodes were used, one placed on either right or left frontal area, depending on the site of the lesion, size of electrode 2x4 inches, and the other electrode at center of occiput, size 3x5 inches. Hair on the occiput was shaved. The electrodes were held in position by an Ace bandage and the patients reclined on a table. In the beginning 400 to 500 milliamperes with medium voltage was used. This was given for a period of 20 to 30 minutes. Treatments were instituted three times weekly, the patients being allowed to rest one-half hour after each treatment. As the patients became accustomed to the treatment we began using as high as 1000 milliamperes, medium voltage, with no appreciable discomfort or ill effects. As the patients became accustomed to this higher amperage the time of treatment was extended to 40 or 45

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minutes. One patient was given a one hour treatment without discomfort.

Observations

The following observations were made during the application of diathermy to the brain. Blood pressure in all cases remained unchanged; pulse rate and respiration became increased; sweating, first profusely about the neck, and then free sweating over the entire body; the body temperature never rose above 99.2 degrees F. Some of the above treatments were given during the hottest days of the past summer without ill effects. Basal metabolism recorded before, during and after treatment showed no appreciable change. Spinal fluid cell count and total proteins showed no change before or during treatments.

In an attempt to understand the effect of the diathermy treatment to the brain, continuous spinal fluid pressure was recorded. This showed a decided and variable rise, ranging from 8 mm. of mercury in one to 40 mm. of mercury in another patient. These increases in spinal fluid pressure occurred without any untoward effects or unpleasant sensations to the patients. Ten minutes after the treatment there was a drop to a more or less normal level. Most of the patients showed improvement subjectively after the third treatment. The following improvements have been reported:

1. Sleep: Patients stated that they were able to sleep through the night, some for the first time during their illness.
2. Tremors: Much less, with better control of the extremities.
3. Spasticity: Reduced, better relaxation. Patients stated the extremities felt much more limber.
4. Circulation: Feeling of warmth to the affected extremities. Patients stated the extremities felt as though life had returned.
5. Mental Attitude: From a morose, depressed feeling to one of cheerfulness and hope.
6. Strength and Co-ordination: Marked improvement; patients who had to be brought to the hospital for treatment were now able to get around alone.
7. Speech: Improvement in articulation; one patient had a complete motor aphasia. Following the fourth treatment this patient began to utter a few words and after the sixth

treatment he stated in his own words "I feel much better."

8. Nervousness: Members of the family stated that the patients were less nervous and seemed more like themselves again.

9. Numbness: Numbness in the affected extremities showed marked improvement and in some cases disappeared entirely.

10. One patient was subject to epileptic fits on an average of three to four every week since the beginning of the illness, now averaged about one or two every month after treatment was instituted.

In an attempt to supplement the information gained from our clinical observations experimental animals were utilized. A trephine opening was made over the midparietal region of dogs. Through this opening after healing took place a thermo-couple was inserted into the brain tissue. Metal electrodes were placed biparietally and the diathermy current was applied. Observations were made simultaneously of the temperature of the skin, brain, and rectum, of cerebro-spinal fluid pressure, respirations and pulse. During the above recordings and treatment the dogs were under the influence of dial injected intravenously. The thermo-couples were extremely sensitive and were calibrated daily.

The following results were noted:

Brain temperature together with rectal temperature was raised. The rectal temperature was gradually raised, beginning about 10 minutes after the current was started. Brain temperature became elevated in a slightly shorter interval and remained at or slightly above the rectal temperature. Skin temperature also became elevated. As the temperature increased the respiratory rate increased and in two dogs as the rectal temperature reached 104 degrees F. the respiratory rate became uncountable. Pulse rate was unaffected until high brain and body temperatures resulted, when it also increased. The cerebro-spinal pressure increased definitely shortly after the current was started and remained high for 10 to 20 minutes after the current was discontinued. Dr. McGlone has prepared a series of graphs to show these changes.

A patient with a cranial defect was utilized, and no anesthesia was given. An experiment was performed as with the dogs. The data secured were unsuccessful because after the treatment it was found that the thermo-couple did not penetrate into the brain tissue

but had instead wound itself into the handle. On one occasion the thermo-couple did penetrate the dura and temperature alterations similar to those noted on dogs were observed. This experiment will be carried out again later.

Summary and Conclusions

A group of patients suffering with hemiplegia were treated by passing diathermy current through the brain. Subjective improvements in the patients were observed, but little objective changes were noted. The brain temperatures cannot be elevated to a point of causing damage by the ordinary diathermy current. The brain temperature is elevated slightly above the rectal temperature in the experimental animal under anesthesia. A definite increase in cerebro-spinal fluid pressure has been produced. This elevation we believe to be the result of increased blood circulation in the brain and its membranes. It is conceivable that by improving or accelerating the circulation of the brain healing may be promoted and hastened. In patients with recent thrombosis, chronic epidemic encephalitis, cerebro-spinal syphilis, improvement of the cerebral circulation by this method may be of benefit. The number of patients of this type studied is too small to make the present observations of great value, but it is our intention to continue these experiments and the results will be reported at a later date.

Discussion

Dr. Luther A. Tarbell (New Haven, Connecticut): It is unfortunate that the essayists have fallen short of their goal. It would have been interesting to have heard their report of the action of diathermy in the acute hemiplegic state, instead of the chronic types, for it would have answered the all important question, is diathermy of benefit to the early hemiplegic state? If the question could have been answered in the affirmative, then the long looked for therapy would have been found and a new era opened up in the treatment of many cerebral affections. Although this era is delayed I see no reason for pessimism. The road is pointed out and it but remains for increasing experience to give us the details.

The important question that needs answering is in regard to its safety. I recall an experience that fits in with the present topic. On the several occasions that I passed a diathermic current through the brain, the outstanding reaction was that of dizziness. This was in a case of double mastoiditis in a physician who had prior to this attack booked passage for Vienna. In the hope of preventing an inevitable operation, diathermy was suggested. The treatment through both

mastoid regions by diathermy was hazardous because of the presence of an acute infection, but the urgency for other measures prompted my extension of the indication for deep heat. The amperage used was higher than usual, being 140 ma. per square inch of electrode surface. After each treatment the patient felt dizzy but otherwise apparently benefited. Recovery took place in a short while. Whether the dizziness was due to the site of treatment or because of excessive dosage I have not determined. I have a conviction that Dr. Martucci and his coworkers have pointed out a potent therapeutic method for hemiplegic conditions which will redound to their credit.

Dr. I. M. Leavy (New York): It has been interesting to hear the presentation by the essayists of their work with diathermy to the cranium in hemiplegia. It requires no little courage to carry out this form of therapy to evaluate its efficacy in cerebral manifestations. Electrotherapy has been previously applied to the head, but it has been so fraught with danger that it has been abandoned as a routine measure.

For hastening absorption, Granger suggested cerebral galvanism by the application of electrodes to the forehead and the neck, two—five ma for 20 to 30 minutes. Leduc of France used the same technic with the application of galvanism, the positive electrode being applied to the site of the lesion.

These treatments offered no definite effect on the paralyzed limbs, since they would require a current of sufficient strength to reach the intracranial contents and it is practically impossible to localize the current to the involved area.

H. E. Stewart mentions the risk and danger by the use of diathermy to the head by causing (1) sudden loss of consciousness, (2) increased intracranial pressure without control of its effects due to capillary expansion, (3) increased amount of intracranial heat because of the bone density of the skull, and (4) the globulin and albumin of the brain tissue to be precipitated by low degrees of heat.

Usually in the hemiplegia, heat is not readily carried by the blood stream, which is essential in diathermy, because of evidence of sclerotic vessels or the presence of blood clot. The heat may lead to dilatation and rupture of sclerosed vessels of the brain.

In our cases, the application of local heat to the extremities is guarded against its effect on the head because of the tendency to hypertension and vertigo, to which these patients become so readily susceptible.

Following the first or second years of cerebral insults in hemiplegia, pathological examinations show the unrestored brain tissue to be replaced either by scar or cystic degeneration. This obviously cannot be restored to function by any known means. In patients with aphasia, more or less restoration may occur spontaneously within two years due to absorption of the resulting edema.

Approximately 75 cases of severe hemiplegia, usually complicated with other diseases, are re-

ferred to our department, at Montefiore Hospital annually, to whom treatments are limited to the extremities by heat and massage, passive and active motions, and galvanism, with marked subjective and objective improvements where the lesion in the cerebrum has made corresponding recovery.

It would be pertinent to ask the essayists why they applied the electrodes to the frontal and occipital regions, as it appears to be a long range to expect diathermy to penetrate brain tissue. Since it is the consensus of opinion that diathermy confines its greatest heat to the area beneath the electrodes and when in contact with dense tissue such as the skull, the resistance offered will either confine the heat to the bone, or follow the vessels and soft tissues of the scalp rather than penetrate interiorly. The lesions usually are in the middle cerebral or lenticulo-striate vessels in the parietal regions, remote from the site of the electrodes; hence the heat penetration to this area would not be readily accessible, even though the heat of the skull were transmitted to the brain surface by conductivity. Also, whether or not the rise in body temperature by diathermy to the skull in dogs may be due to its effect on the heat center in the hypothalamic region, which in the animals is nearer to the brain surface than in man, where it is estimated to be at a depth of six to eight cm. We hope to be able shortly to carry on some experimental work for the determination of the effect of ultra short waves on the heat center in the midbrain.

Dr. Norman E. Titus (New York): The great contribution of this report is that Dr. Martucci and his associates have been able to demonstrate actual changes within the skull due to diathermy. The cerebral action of diathermy is really not new, for I have known of it fully 20 years. The older workers in physical therapy have usually added galvanism through the brain, following diathermy. I would like to impress on you, however, not to use this treatment in cases that are one to three years old.

I myself have never used a dosage of more than 750 milliamperes through the brain. The size of the electrodes is about 2x4 inches and they are applied on the forehead and on the occipital regions. That means that the total surface is about eight inches and that is less than 100 milliamperes of current per square inch. I have never seen any patients suffer from vertigo using the antero-posterior method of treatment. I have never seen any signs of distress evidenced by these patients. By leaving the electrodes in place a galvanic current from a radio battery of 45 volts, B battery, may then be introduced, using from $2\frac{1}{2}$ to $3\frac{1}{2}$ milliamperes of current. Treatment time is 15 to 20 minutes.

There is one very particular point about administering galvanism. We make it a rule that whoever attaches the wires to the electrodes repeats this formula: negative not to the neck; positive, posterior. If the polarity is reverse, syncope will result in almost an instant. If negative polarity is directed on the back of the neck, the patient will faint immediately. If the polarity

is correct, the patients will ask you gradually to turn on the current and they will soon experience a metallic taste in their mouths. When this follows, then you know that you have reached a proper dosage.

Dr. Tarbell spoke about the dizziness. I recently had a case of herpes zoster of the third nerve, which I treated under the direction of Dr. Toomey of the Neurological Institute of New York. He told me if I could stimulate the geniculate ganglion in the brain by giving diathermy through each side of the head, I would know I was affecting the geniculate ganglion and the patient would complain of dizziness. Thus, Dr. Tarbell using the plate at the side of the head got stimulation of that same ganglion and caused the sensation of dizziness. That is not pleasant to the patient and it may be due, in his case, to rather large dosage. We started with a low dosage of 200 ma. with the electrodes in the antero-posterior position. The current intensity was gradually raised to 750 ma. over some eight square inches of electrode. This was continued for about 15 minutes, and later continued up to half an hour.

As regards the interpretation of improvement, hemiplegiacs of a year or more standing are prone to misinterpret the wish for the fact. We have to guard against their enthusiasm. New hope makes them say they feel stronger, eat better, sleep better, and the like. Their morale is improved, and they will cheer themselves on and show favorable subjective changes not justified by anatomical pathology. In recent affections it is remarkable to see how far these patients will come back to a normal level. I recall one hemiplegiac with a history of just under two years duration—a complete paralysis of the left side. She was unable to move a hand or a foot. After 26 treatments of diathermy and galvanism she was able to walk without any brace. While she was not able to use her hand she could swing up her arm so that she could shake hands with you. She could use her shoulder muscles and could walk alone in contrast to previously bedridden condition.

Neurologists interpret the improvement in these cases as something beyond expectation. If we are going to use diathermy, there is no reason why we shouldn't use it early. There is no danger. I have never seen any untoward effects. Undoubtedly, this has been due to the rigid technique as well as the employment of sharp supervision. And now with the advent of short-wave therapy, I have great hopes of better results because of the greater certainty of producing deep heating effects.

Another method used in the past and with good results is that of auto-conduction. The patient is put into a solenoid tube. The body is heated up without being in contact with any metal. That same arrangement can be used in a small solenoid, about a foot and a half in diameter and a foot high in which rests the head of the patient. One obtains by this means a definite heating which has a physiologic influence

on the cerebral path traversed by these eddy currents.

From an experience of about 14 years, I would say you need not be afraid to try cerebral diathermy. It is not dangerous. You may get a little burn on the forehead, or the back of the neck even though you do soak the skin or use KY jelly, which is the best lubricant to use in the hair and on the forehead. If you want to see how galvanism can affect the brain, try it on a patient suffering from a headache following a lumbar puncture. It gives them immediate relief. We do not know why. It is purely an empirical observation for which the patient will thank you.

Dr. Joseph Echtman (New York): In connection with diathermy and mastoiditis, I wish to report a very interesting experience. It is that of a man who used to have epileptic seizures due to a chronic mastoiditis. He was treated by an otologist in the German Polyclinic, in New York. Then he was referred to our clinic. In the beginning I was afraid to give him diathermy. I started with high frequency so as to acquaint him gradually with this particular heat. Eventually, we did use diathermy which produced favorable symptomatic reactions. There was an increase of purulent discharge from his ears. The patient gradually got better. He used to have three or four seizures a day. Eventually he had them only once in six months. The man comes about once a year for this treatment and he is perfectly well.

Dr. Samuel Bernard Hadden (closing): We did not hope or attempt to influence the paralysis in these patients who had hemiplegias of one or two years' duration, because where there is brain softening there can be no restitution of function. About each area of brain softening there is an area of reaction. This we can see can be improved and leave room for some of the subjective improvement occurring in these patients.

There are several advantages about these treatments. The first is that it is an ambulatory treatment and does not require any additional equipment from that in the average hospital physical therapy department. We have felt that the improvement that has occurred in these cases has not been the result of the heating of the brain. As shown by our animal experimental work, there has been very little actual heating of the brain to a temperature above that of body temperature. What we do believe occurred and what accounts for the improvement is that the circulation is reflexly and definitely increased in the brain tissue and thereby improved results. It has been shown that an increase in the brain circulation influences many chronic brain diseases.

For example, the rather classical treatment, that is, the spinal fluid treatment, is based on this physiological aspect: if five or 10 cc. of spinal fluid is removed it can be replaced by nothing but blood. If we increase only one or two cc. of blood flow into the brain with each heart beat, in a

comparatively short time a great quantity of increased blood goes through the brain.

We appreciate, as many of the discussors have said, that many of the reported subjective improvements are the result of the improved morale of the patient. Unfortunately, there have been few objective improvements reported by the patients. Increased ability to sleep is the most constant. But all of us who have had any particular experience with diathermy realize that even if diathermy is applied to a leg or an arm or to the body, that the patients will announce they sleep better as the result of the treatment.

In the experimental animal we have obtained a brain temperature of 108 degrees F. without dire results in the animal. We have already treated several other chronic neurologic diseases. We have in mind continuing the investigations by means of the radio wave rather than diathermy. We have two human patients who have volunteered for experimental work. On one, some little experimental work has been done. Both of these cases have bone defects of the skull. We are going to study the effects in temperature of diathermy upon the human brain. We are anxious to know what the effect is on patients treated soon after their lesion has occurred. We feel if the cases are treated early enough that a much better result will be obtained.

As to dizziness in the patients who have received diathermy by lateral electrode, it is my belief that a hyperemia of the vestibular mechanism caused that, which persevered after treatment was discontinued for some time.

Regarding the question raised by Dr. Leavy, in our experimental work the general body temperature was not reduced. We have some reasonable proof that the brain is not heated by the diathermy. One effect is the increase of the blood.

In the heating of the brain we will have a very definite heating of the hypothalamus, which must be considered a dangerous proposition. With the heating of the hypothalamus the body temperature will be lowered and the patient will not experience any considerable discomfort. The brain temperature will continue to be elevated and may be elevated to dangerous points before the patient experiences discomfort. While we are looking forward to continuing this work in short-wave radiology it will first be done on experimental animals.

Dr. Bartgis McGlone (Philadelphia): In order to determine the heating depth penetration of a diathermic current passed through the brain and its covering, certain experiments were performed. The animals (dogs) were trephined under dial injected intravenously. Trephining was confined to the parietal area about 1.5 to 2.0 cm. to the right of the midline. A complete post-operative period of recovery followed. For experimental procedure dial was again used following a preliminary injection of morphia. The electrodes, 35 sq. in. in area, were placed laterally on

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EDITORIALS

Season's Greetings from the President

To Fellow Members of the American Congress of Physical Therapy:

As President of the American Congress of Physical Therapy I am privileged to extend Thanksgiving, Christmas, and New Year Greetings to its members, and to convey a message of good cheer.

Considering these times of unprecedented stress and uncertainty, the Congress has indeed much for which to be thankful. There must be a good reason why it has steadily increased in membership during the depression, when some other medical organizations are less fortunate. Exceptional merit and efficient management, are the only explanations I can offer for it.

Each succeeding Convention has shown an improvement over the preceding one, and the keen interest in the meetings is evidenced by the large attendance at all sessions. Busy physicians as a class, are bored by anything that will not hold their interest, and the fact that they came to the Conventions in large numbers from distant parts, year after year, is significant.

The influence of the Congress upon medical affairs is considerable, and I think it probable that largely through its intelligent promulgation of facts, physical therapy is rapidly coming into more general use, with its admitted benefits to humanity. The profession need no longer grope blindly, since exact, scientific, and up-to-date information can be gleaned from papers read at the Congress and allied meetings, as well as from well edited articles appearing in the ARCHIVES and other medical journals. Interested physicians therefore, need no longer remain in doubt regarding how and when to employ the different forms of physical therapy.

We have ample cause for Thanksgiving, when the happy present day conditions are compared with those existing in the not far distant past. With the precedents already established, the Congress will certainly further expand in usefulness, power and prestige. It has a bright future, and we have every reason to be very proud of our Congress, and to congratulate ourselves that we are members of it.

The Christmas spirit pervades and warms the hearts of men, independ-

ently of the event that causes Christians to rejoice. Have not we all, regardless of our religious belief, felt and observed the evidence of "Peace and Good Will" everywhere around us, and among all peoples, at Christmas time? It is a time when enmities are softened; truces are called; trespasses are absolved; self-interest modified; friendships asserted, and kindness engendered. Even men of the "Scrooge" type are imbued with the spirit. Under its influence they come to recognize the sweetness of the brotherhood of man, and contritely strike their breasts in repentance for past wrong doing.

Would that the Christmas spirit could supplant such human frailties as prejudices, selfishness, and avarice; then tolerance would abide; hatreds be abolished; jealousies torn from hearts; strife cease; justice rule, and peace prevail.

Human beings, endowed by the Creator with the power of reason, could then truly be differentiated from the beasts of the forest, who are devoid of a sense of right and wrong, and are governed by unreasoning brute instincts alone. It is difficult at times to make such distinction. One has but to read the daily papers to become sadly aware of it. What an indictment of a section of mankind is this!

If the spirit of Christmas could only be instilled into the hearts of men permanently, there would be no crime or warfare to scourge the earth. War is a challenge against the finer instincts of humanity; catastrophe which brings in its wake naught but anguish to conqueror and conquered alike. Let us pray that nations and individuals will eventually see the gross folly of senseless conflict, and find a peaceful way of adjusting differences.

May the day soon come when all humanity will live in mutual confidence, peace, understanding, and security. Only the spirit of Christmas, and not pagan sophistry will make this possible.

Closely following the period when the thoughts of the majority of human beings are spiritually exalted, comes the turning over to a new clean page in the Book of Life. The old pages containing its errors, regrets, erasures and blots, should be forgotten, except in-so-far as remembrance of mistakes will guide to avoidance of future ones. Humanity is crying out for a new deal in the cards dealt by destiny.

May all of us be given clear vision and strength of purpose sufficient to keep faith with our resolutions, thereby contributing toward the ideals of health, happiness, prosperity, the Golden Rule, and Peace on Earth.

Returning to the affairs of the Congress, let us resolve for the New Year, among other things, to contribute our share toward making our national society, in which we are all interested, larger and still better. As an acceptable Christmas and New Year's gift to the Congress, may I suggest that you propose and sponsor at least one new member for the further upbuilding of it. (The number need not be limited.) If you will trouble to do this, it will be a splendid service for all of us, and I shall be gratified. I shall also feel that my humble efforts to promote its welfare have not been in vain.

With every good wish for you and yours, and hoping to greet you next year at Kansas City, where we will doubtless set a new mark of excellence, I remain,

Fraternally yours,

(Signed) WILLIAM L. CLARK.

TRANSCEREBRAL DIATHERMY

The treatment of medical diseases of the brain represents a chapter replete with disappointment and futility. One may summarize our accomplishments in this field as belonging to the domain of diagnosis and prognosis. So far as treatment for conditions other than syphilis is concerned, our entire therapeutic armamentarium has proven ineffective. Accordingly any new contribution that holds out a promise of favorably effecting a variety of diseases of the brain naturally merits the most serious attention and clinical application.

It is regrettable that certain experiments by Erb, performed as early as in 1887, which pointed to a rational approach of this therapeutic problem have not been sufficiently popularized. Erb was one of the first to demonstrate that the fluid content of the brain rendered that organ an excellent conductor for electrical stimulation. His classical experiment consisted of placing an insulated frog muscle on the exposed brain of a human corpse and passing a galvanic or faradic current through the temples which resulted in contraction of the frog muscle. This experiment clearly showed that a current can pass through the brain in spite of its surrounding calvarium.

Applying this concept of conductivity of the brain clinically, Nagelschmidt⁽¹⁾ was one of the earliest workers successfully to practice transcerebral diathermization for circulatory affections, notably in ischemia of the blood vessels due to arteriosclerosis. Kowarschik⁽²⁾ has confirmed by experiment the fact that a high frequency current applied transcerebrally produces a thermic effect on the brain and its membranes. By piercing the skull of an anesthetized animal and stitching a thermoelectric needle into the brain, he found a rise of temperature during the passage of the current.

Schliephake⁽³⁾ enhanced the above experimental research by applying a metal electrode to each temple, suturing a thermocouple under one of the electrodes into the temporal muscle, another into the center of the brain, and still another under the skin at the top of the head, so that it was outside the path of the current. This procedure resulted in an increase of cerebral temperature of 0.9 degrees C. while the temporal muscle showed an increase of 3.3 degrees C. As the thermoneedle at the top also showed an increase of

1.8 degrees C. it follows that the current has also followed the path of the skull. These two experiments leave no doubt that at least a part of a diathermic current applied to the sides of the head will reach and warm the brain itself. While it is true that the current cannot be controlled to affect a selected part of the brain, it is nevertheless clear that we have in the high frequency current an agency by which to favorably influence certain affections of the central nervous system.

Clinically transcerebral diathermization has been almost as effective in indicated conditions as when it is applied to other parts of the body. This is clinically evidenced by creditable reports of cases of headache due to arteriosclerotic lesions, in which pronounced amelioration has been obtained. Perhaps more striking is a report by Kowarschik that diathermization has produced great improvement in a case of amaurosis in a man who became blind following grave intestinal hemorrhage and lowering of the hemoglobin. In this case one eye was gradually restored to normal vision while the other eye, which was affected by a partial optic atrophy, remained unchanged, as was to be anticipated.

We are in accord with Kowarschik in his claim that diathermy increases the flow of blood to and through the brain, by which the serious effects of cerebral anemia are obviated, while at the same time any existing toxic products are removed. Thus for example, the cerebral phenomena due to uremia are controllable by transcerebral diathermization, which, too, has been established by clinical experience.

On the basis of the above data it is proper to study the findings of Martucci, Hadden, and McGlone, in the treatment of hemeplegia,⁽⁴⁾ reported in this issue. Even if we accept that organic cure is not as yet attainable, the fact that these authors have succeeded in alleviating a number of distressing subjective and objective phenomena, and in bringing the patients to a state of better health than was possible before, transcerebral diathermization properly applied, must already be regarded as a distinct contribution to physical medicine.

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PRESENT STATUS OF SHORT WAVE THERAPY

Present day interest in short wave therapy has assumed peculiarly familiar forms typical of almost all great innovations in the sciences. On the one hand we encounter the acclaims of investigators who consider this new form of Hertzian wave therapy as revolutionary in nature, while on the other there is no lack of partisans who favor whispering and underground channels to dampen enthusiasm and to deny recognition to those who see in this new agency virtually a renaissance of high frequency therapy. It would seem that scientific medicine is old enough to benefit from sad experiences; namely, the unqualified and uninvestigated rejection of innovations which through sheer merit have acquired full citizenship even over prejudiced opposition by influential but uninformed individuals. We need only recall the first fate that was meted out by organized medicine to such epochal discoveries as the circulation of blood by Harvey, the discovery of the tubercle bacillus by Koch, the announcement of the spirochete as the true cause of syphilis by Schaudinn, the reports on insulin research, and the fundamental work of Alexis Carrell, to have a warning that it behooves scientific physicians and research workers to weigh with great care and impartiality data presented by workers, both here and abroad, whose reputations alone should commend serious consideration.

Coming closer home, how long did it take the general medical profession to accept the teachings of no less a master-mind than the electrophysiologist, d'Arsonval, the successor to the world renowned Claude Bernard? For years, diathermy, the product of d'Arsonval's ingenious labors was totally ignored while today no general practitioner and no general hospital are considered fully equipped without this agency. What is now claimed for short wave therapy or as we prefer to call it, radiathermy, is nothing mystic or taken from an unknown field of endeavor, but in keeping with the essential principles underlying diathermy. It is an

indisputable fact that d'Arsonval has pointed out long ago the qualities which modern researches are rediscovering in modified form and interpretation of radiathermy. In this country we have not yet, at least not widely, been awake to the therapeutic possibilities which this newer form of what may be properly called ultra-diathermy holds in store. If half of the reports from leaders in recognized institutions are accepted we will have to admit that as Morel-Kahn⁽¹⁾ has so aptly expressed it, "ultra short wave therapy has an incontestible therapeutic superiority over classic diathermy." Cures have been reported which have all the characteristics of the dramatic. Infections and deep seated lesions which in the past have proven obstinate to the inadequate penetration of diathermy and other thermal agencies are now overcome with ease by a technic which differs little from that employed with diathermy, the difference being solely in the form of apparatus providing radiation currents of shorter wavelength.

Already in the European literature, especially in the recent report of Rechou⁽²⁾ and his coworkers we have now not only a general grouping of indications for certain types of individuals who as a class are particularly benefiting from short wave therapy, but a large list of affections whose therapeutic results can no longer be subject to question. Of the latter we find the following indications based on repeated clinical experience even under trying conditions.

Radiathermy has produced affective results in perivisceritis, in acute and chronic and post traumatic arthritides, in affections of the sinus and the ear, notably otosclerosis and oto-spongiosis, cirrhosis of the liver, hepatic insufficiency and such inflammatory affections as furuncles, anthrax, hydro-adenitis, felon, angina, and laryngitis.

We need say nothing here about the general effects of the short wave current for the production of artificial therapeutic fever in the struggle against a variety of certain hopeless conditions, as paresis, tabes, and optic atrophy, for the American literature is replete with information which we may assume to have reached the entire medical profession.

In the light of what has been said we deem it hardly necessary to emphasize that

neither abroad nor here has there been any claim that radiathermy is a panacea for all forms of infection, neoplastic disease, or allergic manifestations against which it has been tried. Insufficient time has elapsed for a final judgment or dogmatic assertion for or against radiathermy. But sufficient clinical evidence is being gathered from day to day which certainly justifies at least an inquisitive attitude by skeptics if it is their desire to bring succor to many unfortunate patients who now have received little if any benefit from our entire range of therapy. First come facts and then only theories.

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THE TECHNICIAN'S REGISTRY

The development of a national registry for physical therapy technicians is an important move to raise the standing of these individuals to the level which they merit. In physical medicine, the technician's position is analogous to that of a nurse in other divisions of the healing art. Like the nurse, the technician requires the recognition which stamps her as qualified to perform routine and special duties. In the absence of any accepted qualifying standards, the term *physical therapy technician*, has been applied indiscriminately to the well trained college graduate who has received special training in physical therapy and to the

scullery maid who may have taken a few lessons in massage. The very fact that an individual belongs to the registry is an indication that he or she has met certain minimum requirements in preliminary education, and in special training and experience to qualify for the position of physical therapy assistant to the practitioner of medicine. The rules and regulations of the registry have been carefully reviewed. The ideas contained therein have received much thought on the part of the members of the special committee appointed by the Congress for this purpose. The American Medical Association, through its Councils on physical therapy and on medical education, has carefully scrutinized the rules and regulations of the registry and made important and helpful suggestions. The spirit of active co-operation between the American Medical Association and the Congress in developing the registry augurs well for the future of physical therapy.

The physician and the technician who will read these rules and regulations will agree that a high standard has been set. Those sufficiently qualified will be able to meet it. Those whose qualifications are insufficient, will have an opportunity of improving them. For the earnest technician, the requirements for registration will prove a stimulus for further educational effort. The registry marks a distinct advance in the art and science of that branch of medicine which is rapidly assuming its rightful place as an integral part of the modern scientific structure designed to alleviate man's suffering and to prolong his life — Physical Therapy.

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the head and 5 to 7 cm. distant from each other. The milliamperage employed varied from 110 to 220 per square inch of electrode; the higher intensities were usually avoided and in the greater number of tests the intensities employed approached the lower value. All temperatures were obtained by the thermoelectric apparatus of Bazett and McGlone. Needle thermocouples varying from 30 to 42 mm. in length were employed for brain temperature; body temperature was obtained by the use of a rectal thermocouple inserted 13 cm., and the temperature of the surface of the thigh by a surface thermocouple.

With 800 ma. (140 ma. per sq. in.) and medium

voltage over a period of 40 minutes the following increases in temperature were observed: brain, 1.3 degrees C., rectal, 2.0 degrees C., surface, 2.3 degrees C. Respiration rate increased from 11 to 33 per minute. Cerebro-spinal fluid pressure rose from 18.0 to 20.4 mm. of water.

Similarly increases were observed with all heating intensities employed, and as was to be expected with higher milliamperages the rate of increase of temperature was greatly accelerated. No attempt was made at the time of this preliminary report to present any discussion of the physiological mechanisms involved; however it is expected that the results of experiments now in progress will be useful in elucidating the factors involved.

SCIENCE, NEWS, COMMENTS

Nobel Chemistry Award for Discovery of Deuterium

The 1934 Nobel Prize in chemistry was awarded to Prof. Harold C. Urey of Columbia University in recognition of his part in the discovery of heavy hydrogen (deuterium). Since the 1934 physics prize and the 1933 chemistry prize unawarded last year are not to be given this year, all of this year's science Nobel awards are to be conferred on Americans. The prize in medicine went to the Americans who developed liver therapy for pernicious anemia, Drs. G. H. Whipple, George R. Minot and William P. Murphy.

Prof. Urey is only 41 years of age and he is professor of physical chemistry at Columbia. He discovered heavy hydrogen in 1931, in collaboration with Dr. F. G. Brickwedde of the National Bureau of Standards and Dr. G. M. Murphy of Columbia University.

Research on the heavy isotope of hydrogen and its compound with oxygen, heavy water, has filled the journals of chemistry and physics. So much research has been under way, and so fast have new discoveries been made, that the National Research Council recently formed a committee to serve as a clearing house for research information in this field. Prof. Urey is chairman of this committee.

Early this year Prof. Urey was awarded the Willard Gibbs medal, another high scientific honor. — *Science News Letter*, November 24, 1934.

We Nominate — For Future Halls of Fame

This being the time of year when Nobel prizes are being awarded, the temptation to list notable science achievements of the past few years is too great to resist.

We nominate for future halls of fame:

The discovery of heavy hydrogen or deuterium, by Dr. Harold C. Urey of Columbia University, Dr. F. G. Brickwedde of the National Bureau of Standards, and Dr. G. M. Murphy of Columbia University now honored by the Nobel prize in chemistry for 1934.

The discovery of artificial radioactivity by Prof. F. Joliot and Irene Curie-Joliot, Parisian husband and wife research team.

The discovery of the positron or positive electron by Dr. Carl D. Anderson of California Institute of Technology.

The discovery of the neutron by Dr. J. Chadwick of Cambridge.

The development by Dr. William P. Murphy of Boston and Dr. Guy W. Clark of Lederle Laboratories of a potent liver extract, one injection of which monthly will control pernicious anemia.

The award of the 1934 Nobel prize in medicine for liver therapy for this disease to Dr. George

H. Whipple of Rochester, N. Y., Drs. George R. Minot and William P. Murphy of Boston.

The successful transplantation of parathyroid and thyroid gland tissue by Drs. Harvey B. Stone, J. C. Owings and George O. Gey of Johns-Hopkins.

The exploration of those bearers of heredity, the genes, within the chromosomes, an epic of biological research in which a half-dozen scientists in America and abroad have participated.

The demonstration by Dr. Leonard G. Rowntree of Philadelphia that the hormone of the mysterious thymus gland visits precocity on future generations.

The development of improved television apparatus, iconoscope and kinescope, by Dr. V. K. Zworykin of Camden, N. J.

The application of the experience of automotive and aeronautical engineering to railroading, resulting in the development of high speed trains of a new mechanical breed.

The adding of 75 miles per hour (60 per cent.) to the speed of transport airplanes without requiring additional power, which came largely as the result of application of National Advisory Committee for Aeronautics research on engine location, cowling and wing sections.

The aluminizing of astronomical mirrors, replacing silvering, with the result that shorter wavelengths of light from the heavens can be caught and studied. — *Science News Letter*, November 24, 1934.

New Band of Ultraviolet Found in Sun's Rays

A whole new band of ultraviolet light rays in the radiation the earth receives from the sun has been detected by the Swiss scientists Edgar Meyer, M. Schein and B. Stoll. The discovery is believed to have an important bearing on future astronomical research.

In their report (*Nature*, Oct. 6), it is disclosed that sunlight is not completely cut off at about 2,800 Angstrom units of wavelength as previous research indicated.

It had always been supposed, as far as proof was concerned, that the ozone in the earth's atmosphere absorbed sunlight of wavelength shorter than those of the 2,800 to 2,900 Angstrom region. Theory predicted otherwise but careful searches to find sunlight of shorter wavelength were unsuccessful in the past.

Using special apparatus which counts individual photons of light energy instead of employing a photographic plate, the Swiss scientists were able to jump the gap caused by ozone absorption from 2,800 to 2,400 Angstroms and detect the new ultraviolet peak having a maximum of 2,100 Angstroms. The new-found rays started to come

through at 2,400 Angstroms. So delicate was the method that the intensity was traced to nearly 1,900 Angstroms. The oxygen in the earth's atmosphere should cut off solar radiation less than 1,800 Angstroms of wavelength.

The research was carried out in a laboratory atop the Jungfrauoch in the Swiss Alps, at an altitude of 3,460 meters — over two miles.

The new findings have important possibilities for high-altitude measurements of radiation from the sun and stars. Mirrors using aluminum instead of silver coatings have recently extended the ultraviolet astronomical front from 3,400 down to 2,300 Angstroms.

Now, at one stroke, astrophysicists can jump the gap caused by ozone absorption and reach still shorter wavelength regions of the solar spectrum. Another important contact with sunlight is thus established. — *Science News Letter*, November 17, 1934.

November Meeting of the Pacific Physical Therapy Association

The regular monthly meeting of the Pacific Physical Therapy Association was held in the lecture room of the Hollywood Hospital, Wednesday, November 21. Three papers were read as follows: "The Rôle of Vitamins in the Treatment of Obesity," by Llewellyn R. Lewis, M.D.; "Water Balance in the Body Metabolism of Obese Patients," by Joseph A. Pollia, M.D.; "Exercises in Girth Reduction," illustrated, by Joseph A. Pollia, M.D., assisted by Miss Jasmine Hilliard, B.S.

Yellow Sodium Vapor Light Reveals Colorless Details

For revealing the details of small colorless objects, the yellow single-color light from sodium vapor is definitely and significantly superior to the ordinary light from incandescent tungsten filament lamps such as are used in everyday lighting.

Drs. M. Luckiesh and Frank K. Moss of General Electric's Lighting Research Laboratory, Cleveland, have reported to the Optical Society of America an appraisal of the visual effectiveness of the new sodium vapor light, about to come into specialized commercial use, as compared with the familiar tungsten filament light.

The advantage of one illuminant over the other depends upon the purpose for which the light is used, the investigators concluded. In addition to revealing details better, the speed of retinal impression is also higher under sodium light for objects that occupy only a very small part of the field of vision.

On the average, the proportion of light reflected by a large variety of colored specimens is practically the same for both illuminants, although there is wide variation in individual colors. Sodium light enhances brightness-contrast between various pairs of colors in more cases

than tungsten light does, but there are many exceptions.

The yellow sodium light often plays strange tricks upon eyes that are accustomed to white light, but measurements of nervous muscular tension as a result of reading gave in the reported experiments no indication of a difference in the behavior of the human seeing-machine under the two illuminants. — *Science News Letter*, Aug. 11, 1934.

Versatile Chemical Plays Seven Roles

One of the strangest Jekyll-and-Hyde roles among the atoms was reported before the meeting of the American Chemical Society by Dr. Walter H. Hartung of the Sharp & Dohme Chemical Company of Philadelphia.

The multi-faced substance is known chemically as propiophenone. Chemists know accurately its composition, or atomic "skeleton." It is a chemical having a pleasing odor that lends itself to blended perfumes. But by changing the kind of atom "flesh" through chemical manipulation, scientists are able to produce thirteen different compounds, all active physiologically and representing seven different types of activity.

From propiophenone it is possible to build up two kinds of local anesthetics, a flavor suggesting licorice, a germicide eight times as powerful as carbolic acid, a chemical causing crying, and the stimulant ephedrine.

Propiophenone rivals other organic chemicals reported which, while having the same basic atom skeleton, are found on such widely different things as cholesterol, vitamin D, the bile acids, the sex hormones and cancer-producing coal tar products.

"While there is abundant evidence of relationship between physiological action and chemical constitution," declared Dr. Hartung, "our knowledge thereof is yet so elemental that we can not even yet vault the low hurdle raised by the chemical family descended from a simple substance like propiophenone." — *Science News Letter*, September 29, 1934.

New Weight-Reducing Drug Should Be on Poison List

Dinitrophenol, potent new weight-reducing drug, should be added to the poison list and its sale regulated so that it can be obtained only on a physician's prescription.

This step was urged as a safety measure by Drs. M. L. Tainter, W. C. Cutting and A. B. Stockton at the meeting of the American Public Health Association. These Stanford University scientists were the first to report the use of the drug as an obesity remedy.

"Probably at least one hundred thousand persons have been treated with the drug in this country alone," Dr. Tainter declared in reviewing the results obtained with the remedy since he and his colleagues first studied its possibilities

in 1931. It has also been used in Canada, Great Britain, France, Sweden, Italy and Australia.

Three deaths have been reported from its use. One was in a psychiatric patient and there is some doubt in Dr. Tainter's mind as to whether the drug was the cause of his death. The other two were a physician who took two tremendous doses and a girl who bought the drug on her own responsibility from a druggist and took a very excessive dose. Excessive amounts of the drug cause death by producing a fatally high fever.

A possible means of treating this dangerous fever was suggested by Dr. Tainter who said that in animals, at least, the fatalities from the fever of dinitrophenol can be prevented by chilling the skin with ice packs and by giving oxygen inhalations.

The main disadvantage to the medical use of the drug is the very alarming and unpleasant skin rash which it sometimes produces. A saving feature is that about half the patients who have had one such skin reaction are able, after a short interval, to continue the treatment without further difficulty.

Dr. Tainter and colleagues were unable to find that the drug, in proper dosage, had any harmful effect on liver, kidneys, blood, digestive tract or blood pressure or circulation. Patients with high blood pressure can be treated like other patients, and as they lose weight the blood pressure is usually lowered and the accompanying symptoms of that condition improved. There is always a possibility that some persons may have an idiosyncrasy for the drug and in these patients harmful effects might be produced by even the correct doses.

Because it is such a potent remedy Dr. Tainter urged not only that its use be limited to physicians but that even doctors should not use it until every other remedy for reducing weight, including careful dieting, had been tried. — *Science News Letter*, September 29, 1934.

Blood Vessels Aid in Feeling Temperature

You feel a flatiron as hot or a piece of ice as cold not because of the action of a special temperature mechanism in the skin but through the action of your blood vessels. The heat dilates or enlarges your blood vessels, while cold, on the other hand, contracts them. This theory, opposed to the commonly held one of a special skin mechanism for feeling temperature, was proposed to the American Psychological Association meeting in New York City by Dr. John P. Nafe of Washington University, St. Louis, Mo.

The cornea of the eye, which contains no blood

vessels, cannot feel temperatures, Dr. Nafe reported. The fact that warmth is perceived gently as a gradual flowing in, while cold seems sharp and quick, also points to the origin of the sensation in the blood vessels, he believes. When you place your left hand in cold water, the blood vessels in your right hand also contract and within three seconds your right hand becomes more sensitive to heat and less sensitive to cold, Dr. Nafe has found. — *Science News Letter*, September 29, 1934.

Blue Light Most Effective in Causing Plants to Bend

When plants in a window-box, or potato sprouts in a dark cellar bend toward the light as they grow, they are not responding equally to all the colors in the great mixture of lights we call white light. Toward red light they will not bend at all, while on the other hand there are certain wavelengths in the blue region of the spectrum, toward which they are especially sensitive.

Recent researches at the Smithsonian Institution, reported before a Washington botanical audience by Dr. Earl S. Johnston of the Institution's staff have picked out very sharply the particular wavelengths that are most potent in stimulating plant bending. The most effective of all light wavelengths is a very narrow band in the neighborhood of 4400 Angstrom units, which is in the blue part of the spectrum. From this point the effectiveness of light in producing bending falls off rapidly to a point near 4600 Angstrom units, which is still in the blue region. Then it rises again to a secondary peak at about 4750 Angstrom units, a slightly greenish blue, and then drops to an "almost-no-effect" point beyond 5000 Angstroms, in the red.

In carrying out his experiments, Dr. Johnston used plants themselves — young oat seedlings — as pointers. At one end of a long, darkened box was a standard lamp. At the opposite end was another lamp, with suitable filters to permit only light of the desired wavelengths to pass through. The seedlings were placed between these lights, and permitted to "choose," indicating the light having the greater effect by bending toward it.

The standard lamp was moved back and forth, until one of the seedlings indicated "no choice," showing that the two light sources were in balance. Then a sensitive light-measuring instrument was substituted for the seedling, to obtain the relative amounts of energy put forth by the two lights. In this way a sensitivity curve for the effectiveness of all parts of the spectrum was built up, based on the "choices" of many hundreds of seedlings.

THE STUDENT'S LIBRARY

MEDICAL TACTICS AND LOGISTICS. By Colonel *Gustavus M. Blech*, Medical Reserve Corps, U. S. Army, and Colonel *Charles Lynch*, Medical Corps, U. S. Army, ret. Special binding. Pp. 205. With four colored topographic maps. Price \$4.00. Springfield, Ill.: Charles C. Thomas, 1935.

Those of our readers who are interested in preparedness for national defense will welcome this book just off the press. The principal author (Blech) is well known to readers of the *ARCHIVES* as one of our most active associate editors. Of him and his distinguished co-author, the Surgeon General of the army, says in a foreword of the book: "Both authors have served in the Medical Department for a generation, and have distinguished themselves by unusually meritorious service in peace and war." The Surgeon General qualifies the book as "constituting a valuable addition to the training literature prepared especially for Medical Department officers." Such an official endorsement by the highest authority of our land precludes critical comment of the work on the part of the reviewer. We therefore content ourselves with a brief review of the contribution on a subject which in these troublous times merits the serious attention of all able-bodied patriotic physicians.

The book is divided into three parts. In the first the authors present an interesting review of the philosophy and theory of war, of the development of the methods of warfare with particular reference to the purpose, organization, and function of the diverse medical units at the front. In the second part the authors present concrete tactical studies to develop the leadership of responsible medical officers before, during, and after battles. They lead the reader through an imaginary war between Pennsylvania and Maryland in so vivid a manner that one feels one's self part and parcel of the combatants struggling for military supremacy, sharing with the youngest and the highest medical officers their trials and tribulations in caring for the sick and wounded. Beginning with simple advance marches, small and large units are seen in defense, retreat, and the final attack by one side and defense by the other side, the operations of both combatant and medical forces being presented in so simple yet technical language, that even a neophyte can visualize the various events with the aid of specially prepared maps. The third part is devoted to the peculiarities of the medical service of large cavalry forces and to minor technical points that could not be incorporated in the tactical section, e.g., night marches, medical supply system, winter campaign, night operations, principles governing the professional practice of medicine and surgery at the front, and the like.

Finally the book contains an Appendix providing useful tables of reference, medico-military information officers are supposed to be familiar with, a

glossary of military terms, and a list of official abbreviations of military terms. Bibliographic references and an index conclude the volume. The mechanical make-up of the book is in keeping with the artistic format typical of all productions of this well-known medical publisher. Judging the book even from a layman's standpoint, it represents an unusual effort as well as a patriotic inspiration meriting widest perusal.

L'ANNÉE ÉLECTRO - RADIOLOGIQUE (Electroradiologic Annual). First Year. By *Morel-Kahn* and 10 collaborators. Carton. Pp. 232. With 28 illustrations. Price 40 Francs. Paris: Masson et Cie, 1934.

It was a foregone conclusion that any literary labor undertaken by Dr. Morel-Kahn of Paris, would possess unusual merit. Accordingly it is not surprising that instead of the usual types of "annuals" we are presented with a practical yet critical review of the recent advances made in the field of electroradiology. Morel-Kahn is no stranger to American physical therapists and radiologists, for he has not only contributed original articles to the *ARCHIVES* but has addressed the recent Congress in Philadelphia in person.

The small volume under discussion shows that the editor and his associates were animated by a desire to bring to general practitioners as well as specialists an adequate knowledge of what outstanding electroradiologists have contributed to the diagnostic and therapeutic measures by x-rays and other physical agencies. The vastness of the subjects and of their literature has necessarily forced on the editor and his collaborators a process of selection, a task which has been realized in a highly satisfactory manner.

The text proper is divided into three main sections embracing radiodiagnosis, general radiotherapy, and electrology. An idea of the way each subject matter has been presented can be had from the very first chapter devoted to radiography of the mammary gland. After a good description of the proper technic of securing the right kind of x-ray plates, the findings in normal breasts are described in detail. This radio-anatomic study is followed by discussions of the findings of abnormal conditions of the breast and its neighboring areas, benign as well as malignant. No claim is made that radiography is conclusive in itself, but it is clearly pointed out to what extent it facilitates differential diagnoses. Similarly such subjects as parathyroid osteosis, meningiomas, accessory lobes of the lungs, intravenous urography, new methods of visualization of the gall bladder, bronchography, cancer of the stomach, and other interesting chapters are treated with careful consideration of moot problems. In the first section we note with some sur-

prise also a chapter on encephalography, in which Morel-Kahn considers the indications and contraindications of injection of air via the lumbar route, as the only practical method to be considered at this time. This view is in contrast to that held by Professor Moniz' work with angiography. In the present volume the opinion is expressed that all other methods, that is, including visualization of the cerebral blood vessels, have not yet attained practical applicability.

In the section of general radiotherapy a chapter on the x-ray treatment of inflammatory affections is of especial general interest, while dealing with the treatment of lymphogranulomatosis it concludes with the caution that in certain cases resort to surgery may become necessary. A chapter on Coutard's treatment of deep cancers will prove of great interest to radiologists; another one, a critical review of the work accomplished with Curietherapy in cancer of the cervix (in the cancer institute in Toulouse), contains much interesting material also for gynecologists. High tension roentgenotherapy is discussed rather in a favorable sense with the concluding remark that fractional treatment is perhaps the real reason of the successes obtained, and that it is yet too early to draw conclusive inferences. A chapter on the x-ray treatment of Basedow's disease gives us a good idea of the practice in vogue in France.

Perhaps the section on electrology will prove to most of us of greatest practical interest, because we find in it not only reviews but descriptions of apparatus and technics. Chapters on rectified high frequency currents, dielectrolysis, sensitive chronaxia, short wave therapy, ionization of histamine, and electrotherapy in gynecology must be read in the original as they do not lend themselves to a discussion in a book review. Suffice it to say that with the exception of the artificial production of hyperpyrexia the volume does not give one the impression that in France at least they are confident that short wave currents will completely revolutionize our therapy with diathermy. However, the reserved attitude appears to be judicial rather than prejudicial, since its positive results have been given due consideration.

Finally the book contains an appendix in which we are given brief reports of the discussions at recent radioelectric congresses in various European countries. Bibliographic references are given at the end of most chapters, but mostly of French origin. Taken as a whole the volume brings us a splendid review of the practices in the authors' country without, however, failing to take cognizance of the advances made throughout the civilized world.

LECTURES ON MEDICAL ELECTRICITY. By *Elkin P. Cumberbatch*, M.D. (Oxon.), D.M.R.E. (Camb.), F.R.C.P., Medical Officer in Charge, Electrical Department, and Lecturer on Medical Electricity, St. Bartholomew's Hospital; Examiner in Medical Electrology, University of Cambridge, etc. Cloth. Price, 10/6 net. London: Henry Kimpton, 1934.

This book is a welcome and original contribution by a distinguished pioneer and teacher of physical therapy. It consists of a series of lectures on medical electricity, infrared and ultraviolet for medical students, and is presented in a style so delightfully informal as to stimulate increased interest toward a practice that is frankly technical and somewhat foreign to both the novice and general practitioner of medicine. Undoubtedly this work is also bound to provoke an inspirational influence upon that small but important group—the physical therapy instructors in other schools and lands. For the latter group this work will be found to contain a wealth of suggestions and guidances for demonstration purposes—a fact well recognized but indifferently utilized in American institutions of medicine. In the space of 236 pages the author has managed to introduce in detail the physical nature and physiologic and clinical action of the various electrical and radiant agencies employed in modern medical practice, this being expatiated in 12 closely knit lectures, each having the distinguished index of scholarly spontaneity that only comes from wide experience and maturity of judgment.

From the space devoted to certain agencies it would appear that greater preferment is given to galvanotherapy and electrical diagnosis, in contrast to high frequency and radiation therapy. Sufficient detail is nevertheless introduced into the latter sections to provide a comprehensive picture of their importance in physical therapy practice. One notes, however, certain omissions from this text that have to do with the newer contributions in the field. We fail to find mention of histamine iontophoresis and shortwave radiathermy, two contributions that have revived the flagging interest in our discipline. The literature on these topics has been sufficiently extensive for the past several years to provide definite conclusions regarding their clinical value and physical properties. Undoubtedly this will be properly evaluated in a future edition. The book as a whole is a splendid example of how a difficult subject can be presented in a scholarly but informal style—a style so vivid and lucid as to stimulate the deepest interest of the student.

INTERNATIONAL ABSTRACTS

Physiological Effects of Radio Waves. Joseph L. Donnelly.

Science 78:290 (Sept. 29) 1933.

The statement is common that only living material is heated when exposed to short radio waves. This is shown to be erroneous by the observations of Hosmer and McLennan, but because this impression persists Donnelly conducted a series of his own experiments. To this end he subjected a series of simple solutions to high frequency currents.

Concentrated solutions of various electrolytes, such as potassium chloride, barium chloride, acetic acid, sulfuric acid and sodium hydroxide were found to be slightly heated, but the intensity of this heating increased with dilution to a maximum, decreasing with still further dilution. The amount of heating was found not to be the same for a given concentration of different substances, or a function of the concentration of a given electrolyte varying, rather, with its specific electrical conductivity. Thus, normal acetic acid, having a higher resistance, was heated more than normal sulfuric acid.

Donnelly found dilute solutions of such purified dextrose not to be heated by high frequency currents. When the concentrated syrups did show a slight elevation of temperature he felt that it was due to contamination with electrolytes from the containers, etc. A sample of twice distilled (crystalline) phenol was partly liquefied when irradiated, but a thermometer fixed in the mass recorded no change in temperature. Neither did solutions of low concentrations of water dissolved in the phenol or of phenol dissolved in water show temperature increases. A solution of dry hydrogen chloride in benzene remained unheated. The explanation of the selective effects is dependent upon the fact that neoplastic, "inflamed" or "injured" tissues are richer in water than normal tissues. They represent a shift in the protoplasmic system from a "dry" hydrate toward a better solution of the constituents of protoplasm in water and are therefore peculiarly sensitive to the action of radio waves. The shift, in other words, makes a better solution of electrolytes in water and is analogous to the change which is suffered by a soap or proteinate solution when heated or diluted, thereby suffering a change from what was originally a solution of water in the soap or protein to one of the soap or protein in water. A distinguishing characteristic of neoplastic growth is its ability to liquefy its medium and thus to continue its growth.

Just as concentrated solutions are little heated by electromagnetic waves while more dilute ones are better heated, even so will a neoplasm bathed in a dilute and salt-containing solution of protein,

or the more highly hydrated, soluble and edematous infected tissue be more strongly affected (heated) by such waves than the more normal, "concentrated" and water-poor tissues.

Investigation of Deep Heating of the Human Organism by the Short Wave Field. (Untersuchungen ueber die Tiefenerwaermung des Menschlichen Organismus im Kurzwellenfeld). Rhondorf F. Schultze, and W. Rach.

Archiv f. Gynäkol. 157:468, 1934.

Animal experimentation of the author as well as of other scientists has shown that the action of short electric waves may provoke thermic lesions of the deeper tissues. It is precisely this strong, deep action which ought to be a chief characteristic of treatment by the electric condenser field; it is said to manifest itself not only by a specifically biologic, but also by a strong heating action. Thus the entire effect depends on the strength of the field, the peculiarity of the tissue and the length of wave, the temperature being diminished in proportion as the wavelength is decreased.

The authors worked with the Universal-Radiotherm of the firm Siemens and Halske, i. e., with a six and with a 30 m. wave. With the latter wavelength the so-called short wave diathermy, deep heating naturally, was expected to play an important therapeutic rôle, which fact is also always considered as of special advantage. In order to obtain actual data regarding this phenomenon it seemed necessary to ascertain the extent of this deep heating.

Thermo-elements, i. e., metal instruments, should not be used for such temperature measurements, because it may result in overheating, and hence in erroneous measurements and production of local lesions. For this reason the instruments used were for the most part alcohol thermometers.

The observations were in the main made on women for affection of the abdominal organs. The treatment of the pelvic organs forms the most difficult domain of the short wave therapy because of the density and thickness of the tissue of that point, although this field of organs is from anatomical reasons especially fit for the dangerous test of deep heating.

In all of the cases the electrical field was directed through the ventro-dorsal direction; one of the two electrodes rested in the symphyseal region, the other on the gluteal region.

During the short wave therapy the temperatures were at first determined in the urine filled bladder; a pronounced heating action could not be recognized. In other cases the temperature was also studied in the vagina and in the rectum;

here, too, the authors found the temperature constant. A noticeable heating of the skin, however, could be ascertained and the patients also experienced a definite heat.

Thus with a 30 m. wavelength, no measurable heating of the deep tissue layers was obtained. The absence of deep heating by short wave therapy of the abdominal organs proves, of course, to be only negative as regard the dynamics of this therapy, but does not explain its effective usefulness, which is often very distinct. The experimental conditions used by the authors affords, a true but restricted insight into the thermo-electric, but not into the electro-chemical actions of short wave therapy.

Short Wave Therapy in Children. (Kurzwellen-therapie Bei Kindern). Ernst A. Voss.

Kinderärztliche Praxis 5:289, 1934.

The author presents some indications for short wave therapy which are based on the treatment of 180 children: Furuncles and abscesses, in particular facial types (in general furunculosis the treatment was less useful), acute glomerulonephritis, chronic non-specific diseases of the lungs and of the pleura, (for chronic pneumonia short wave therapy is regarded as a contraindication as it produced a regular relapse of the process), urticaria and strophulus (rolling the waves — mobile treatment—through the abdomen brought about immediate success though temporary in parts). The treatment was supposed to work as a suggestive remedy against functional troubles

Short Wave Treatment in Oto-, Rhino-, Laryngology. (Kurzwellenbehandlung in der Hals-, Nasen- und Ohrenheilkunde). Th. Hünemann.

Fortschritte d. Medizin 52:165, 1934.

Short wave treatment acts conjointly with diathermy in producing heat and by that way producing an artificial hyperaemia. It seems to work chiefly in a biological sense, owing to the fact that the concentration of hydrogen ions is increased in the radiated region. Presumably the radiation acts upon the albuminates first. Most of the authors agree in commending on the good results obtained in acute inflammations, due first of all to a lower sympatheticotonus and to a higher vagotonus. The irradiated area shows a considerable dilatation of the capillary bed persisting for some hours, which is explained on the above reaction. Besides this the serum shows an acidific state. Phagocytosis is stimulated, and the mobilization of the calcium ion makes up for the decrease of potassium and sodium in the tissue and thus raises the impermeability of the injured cellular membranes. In the practical use of short waves and in order to secure the results desired, we have to look after the shape and size of the electrodes, taking care of their distance from the surface of the body. By means of modifying that distance we may regulate a homogenous radiation of the body on the one hand or a concentration of the current lines at

certain places (for instance at the antrum) on the other hand. With regard to the intensity of dosage we should pay particular attention to the patient's sensations toward heat. In trigeminal neuralgia (tic-douloureux) every precaution should be used in the dosage of the treatment.

Diathermy Treatment of Iritis. (Die Diathermiebehandlung der Iritis.) G. Cepero, and L. Comas.

Zeit. f. Augenhkde 94:211, 1934.

In constructing suitable, apparatus of adequate performance the authors were able to overcome the difficulties which hitherto were encountered in the use of the diathermy treatment in ophthalmology. Excellent results were attended in iritis of all types, in keratitis interstitialis, in corneal ulcers, in inflammatory processes of the optic nerve. In the second place mention should be made of early stages of cataract and opacity of the vitreous body. Generally speaking the antiphlogistic, eutrophic and analgetic effects are characteristic for diathermy. The bactericidal effect and the effect in the sense of stimuli for local defensive efficiency are more likely due to a direct action of the high frequency waves (i. e., vibration on account of high periodic fluctuations of the colloidal intraprotoplasmic micells and ions, forming the electrolytes of protoplasma). The caloric effect is of less importance in this instance.

For septic processes diathermy is contraindicated as it may spread the infection, as also for active hemorrhages, after which, however, the resorption is favored by diathermy. All types of iritis, in particular the syphilitic type, are well adapted for diathermy treatment. Eyes with the slightest visual power and filled by exudation, without red reflexes in the fundus oculi and with intensive infiltration of the iris and the cornea, were restored to normal conditions and functions by diathermy. Traumatic and postoperative iritis were attended by excellent results, too. In secondary purulent iritis the primary suppurative focus must be removed (tonsils, prostata, etc.).

Recent Advances in the Treatment of Lupus Vulgaris. Evelyn M. Holmes.

Lancet 225:1033 (Nov. 4) 1933.

During the past 12 months there has been a revolution of the older methods; a new lamp has been constructed which has superseded and replaced all the older types because of its easier mechanization, cheaper running expense, and greater biological and clinical efficiency. The general features of the lamp are described in an appendix to this paper. The essential principles are the same as in the old Finsen and Finsen-Reyn lamps, but there is more effective filtering of the rays and the mechanization of the control and application excludes the variable personal factor and allows a saving of staff in time, number and expense. One of the new lamps is in fact equal in administrative and clinical value to three of the old lamps. Each individual

"treatment" is effected more speedily and more surely. A patient may have four to six treatments a day, and day after day in quick succession, until a wide area is attacked and "cured." In this way extensive lupus is cleared up completely or almost so in the course of three months; in certain cases this speeding up has turned the scale in favor of the patient in a case otherwise apparently hopeless. Further, the result seems more permanent in the cases treated with the new lamp. Art in the treatment is more readily acquired than with the old lamp. Some striking illustrations of what the results may be have appeared in *Ugeskrift for Laeger* (1932, p. 946).

General carbon arc lamp baths are given to most patients in addition, and other treatments as necessary. Patients are never discharged as cured. According to their state they are advised to return for review in three, six or 12 months' time, and if still clear, to return in two years.

Physical Therapy in California. A Special Committee Report.

California & West. Med. 39:297 (Nov.) 1933.

A special committee on physical therapy was appointed by the council of the California Medical Association in September, 1932. The committee consisted of Drs. Charles L. Lowman, Howard Naffsizer, Rodney F. Atsatt, H. Leslie Langnecker and John Severy Hibben (chairman).

There are only two state committees in physical therapy in the whole United States—one on the eastern coast, the other on the Pacific coast. How can physical therapy get adequate recognition unless more state committees are formed? It would aid greatly if at least one-half of the states had well organized functioning committees. As soon as the medical profession understands that we are not merely trying to promote physical therapy, but are seeking to regulate its practice and turn the tide into legitimate channels, there should be no difficulty getting committees organized. Then on the day before each annual meeting of the various state medical societies, and while working in conjunction with the plan of the American Congress of Physical Therapy, we could have presented both constructive and instructive physical therapy programs.

Electrocoagulation of Cervical Erosions and Endocervicitis in Late Puerperium. A Study of Follow-up Results in a Series of Patients at the Woman's Hospital. Ralph L. Barrett. J. A. M. A. 103:1516 (Nov. 17) 1934.

Barrett found in his series of post natal examinations (six-eight weeks post partum) unhealed and damaged cervixes in 50 per cent of patients. He therefore coagulated the cervix in 120 patients of whom 81 were primiparae and 39 were multiparas. A repeated coagulation was necessary in two patients and two other women had post operative bleeding, one on the eighth

day and the other on the 14th day. This did not delay healing in any way. All of the patients were followed for three subsequent menstrual periods, and no cervical stenosis was noted. Four patients were later delivered by the vaginal route without any cervical dystocia. The method employed consisted in an active ball electrode, and an inactive electrode of woven mesh strip around the thigh. The best results were obtained when deep coagulation of two-five mm. was used. For purposes of removing polypi or biopsy a wire loop was used.

A New Treatment for Eustachian Tube Obstruction: Controlled Heat Bougie. Emanuel Simon.

Am. Otol., Rhinol., and Laryng. 43:598 (June) 1934.

The author described a new type of apparatus for controlled Eustachian heat bougie. He gives the technic and reviews the literature in an effort to rationalize this treatment in certain types of tubal disease. He contends that the heat bougie will open the most rigid stricture, will keep the tube open longer, and with less frequent treatment than any other procedures known to him. According to Simon, the danger in using the heat bougie is negligible and with average attention is nil. In his opinion, it is the best procedure in cases of acute, catarrhal otitis media, of two or more weeks' duration; in chronic catarrhal otitis media it will give more improvement than any other treatment; in the acute purulent type of three or more weeks' discharge it frequently permits drainage through the tube with cessation of the discharge; in chronic purulent otitis media the results have been only fair.

Treatment of Peptic Ulcer by Diathermy of Sympathetic. P. A. Grot, and B. A. Egorov.

Klin. Med. 11:140 (Nos. 3 and 4) 1933.

Grot and Egorov report the results of diathermy treatment of the cervical portion of the vagus and the sympathetic nerves in 20 patients with peptic ulcers of the stomach and the duodenum. From five to 15 treatments of 30 minutes duration gave excellent results. Epigastric pain, pyrosis and eructations disappeared and the acidity came down to a normal level. The symptom complex characteristic for these patients consisted of spastic pain, pylorospasm, increased acidity and increased secretion, symptoms resulting from increased irritability of the vagus nerve. They noted in several patients a peculiar syndrome suggesting partial lowering of the sympathetic tonus; namely, narrowing of the palpebral slit, ptosis of the lid, and hypotonus of the muscles of expression on one side of the face. The authors suggest that the effect of the diathermy current is conveyed along the trunk of the vagus to its ramifications in the wall of the stomach, thus lowering its irritability. At the same time the diathermy improves the tonus of the sympathetic nerve. To throw light on the nature of the effect of the diathermy, observa-

tions were undertaken on a number of other conditions, such as achylia, biliary colic, cholecystitis and angina pectoris. These will be reported at a later date.—J. A. M. A. 101:416 (July 29) 1933.

Anti-Rachitic Activation of Milk by Direct Irradiation with Ultraviolet Rays. G. C. Supplee.

Am. J. Public Health 23:225 (March) 1933.

Supplee emphasizes the fact that, since milk is the sole or major article of the diet of every child during the age of greatest susceptibility to rickets, the desirability of having a milk available containing an adequate amount of vitamin D for the prevention or cure of rickets is at once obvious. Such a product would provide a new type of prophylaxis, simple in application, economical and entirely free from the inherent handicaps involved in the use of the better known specifics. Such an achievement presupposes the correlation and control of basic factors concerned in the irradiation technic. The industrial application of methods for the direct irradiation of milk must take into account numerous interrelated factors. Facilities must be provided for the exposure of large volumes of milk to suitable ultraviolet radiations within short periods of time. In order that the cost of the treatment may be kept to the lowest possible minimum, the accessory equipment must be simple in construction and susceptible of efficient and uniform operation without the necessity of providing especially trained or skilled labor.—J. A. M. A. 101:402 (July 29) 1933.

Application of Heat in the Medulla Oblongata.

Letter from Paris July 5, 1933 to J. A. M. A. 101:614 (Aug. 19) 1933.

Research presented before the Academy of Medicine by Mr. and Mrs. Andre Pupier and Mr. Rene Preur has shown the good effects, in the treatment of vomiting of widely different origin, by application of heat to the medulla oblongata, which appears to be involved in the mechanism of many cases of vomiting. The causes of vomiting are many, and the incitations to vomiting may have various points of origin—abdominal viscera, pharynx, inner ear,—all of which involve the medulla oblongata. Certain poisons, such as apomorphine, act directly on the medulla oblongata and provoke vomiting. Further, the masseurs of India massage the back of the neck of submerged and asphyxiated persons to restore the vitality of the bulb. The authors raise the question whether an exterior physical action, more particularly the application of heat to the bulb would not forestall or check vomiting irrespective of the cause. The necessary thermic effect was accomplished by means of electricity. With a temperature of about 50 degrees C. (122 degrees F.), heat applications were found to be effective when continued for from two to 10 minutes. With the fluoroscopic screen one can observe that the action of heat on the bulb

eliminates spasms of the pylorus that have not yielded to the usual therapeutics. The vomiting of pregnancy, other forms resulting from hepatic or gastric disorders, nausea due to various modes of locomotion (railway train, boat, automobile, airplane) were quickly checked in nearly every case. Even seasickness was much benefited. Migraine and insomnia were favorably influenced; urticaria was attenuated. From numerous observations, furnished by both patients and physicians and collected by the authors, it appears that the applications of heat to the bulb have given good results in more than 90 per cent of the cases in which they have been employed.

Retinal Detachment Treated by Diathermy. E. F. King.

Brit. J. Ophthal. 17:287 (May) 1933.

King treated 31 cases of retinal detachment by diathermy. He believes that the following conclusions are justified: 1. The diathermy method of cauterization for the treatment of retinal detachment is preferable to the thermocautery used by Gonin or the solid caustic potash used by Guist. Further, the technical difficulties are considerably less than in the latter operation. 2. Cases in which no hole can be found and those in which a previous operation for detachment, of any type, has been done, offer small hope of success. 3. The age of the patient is of small importance but the prognosis is much less favorable when the symptoms of detachment are of long standing. 4. Almost all patients showing inflammatory signs, postcortical lens changes, gross vitreous opacities and hypotension do badly, while in those with a relatively clear vitreous discrete hole or holes and a normal tension the prognosis is favorable. Of the 31 patients, 18 were cured. Eleven of these left the hospital with no visible detachment; in seven there was seen around the cauterized area, a certain amount of residual detachment due, no doubt, to local swelling of, and possibly exudate from, the choroid. In no patient has an increase of this local detachment been noted at subsequent examinations. In most of the cured patients the field to a one degree object at one-third meter was full or showed only a small loss corresponding to the site of operation. The improvement in central vision was variable; if the macula had been detached, from counting fingers, vision of 6/60 or 3/36 was usually obtained, while an increase of one or two lines on Snellen's type was general in the patients in whom the macula was still attached.—J. A. M. A. 101:813 (Sept. 2) 1933.

Liver Extract Against Radiation Sickness. F. G. Dietel.

Str. Ther. 48:110, 1933.

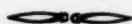
Injection of 2 to 4 cc. liver extract cured radiation sickness (Röntgenkater) of 15 women within an hour. The effect seems to be due to the rise of the cholesterol level by the antiperniciosa principle.

End

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- Acta Radiologica. Stockholm.
 American Journal of Cancer. New York.
 American Journal of Diseases of Children. Chicago.
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 American Journal of the Medical Sciences. Philadelphia.
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 Archiv für Verdauungs-Krankheiten. Berlin.
 Archiv für Gynäkologie. Berlin.
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 Archives of Otolaryngology. Chicago.
 Archives of Pediatrics. New York.
 Archivio Italiano Di Urologia. Bologna.
 Ars Medici. Vienna.
 Atlantic Medical Journal. Harrisburg, Pa.
 Australia and New Zealand Journal of Surgery. Sydney.
 Beiträge zur Klinik der Tuberkulose. Berlin.
 Biologische Heilkunst. Dresden.
 Boletín de la Asociación Médica de Puerto Rico.
 Boletín del Instituto de Medicina Experimental para el Estudio y Trataniento de Cancer. Buenos Aires.
 British Journal of Actinotherapy and Physiotherapy. London.
 British Journal of Children's Diseases. London.
 British Journal of Dermatology and Syphilology. London.
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 British Journal of Surgery. Bristol.
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 British Medical Journal. London.
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 Bulletin of New York Academy of Medicine. New York.
 Bulletin of San Juan de Dios Hospital of Manila. Manila.
 Bulletin of the State Board of Health of Kentucky. Louisville.
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 Indian Journal of Medical Research. Calcutta.
 International Journal of Orthodontia and Dentistry for Children. St. Louis.
 International Medical Digest. Hagerstown, Md.
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 Journal of the American Medical Association. Chicago.
 Journal of the Arkansas Medical Society. Little Rock.
 Journal of Cancer. Dublin.
 Journal de Chirurgie. Paris.
 Journal of Experimental Medicine. Baltimore.
 Journal of the Indiana State Medical Association. Ft. Wayne.
 Journal of Industrial Hygiene. Boston.
 Journal of the Iowa State Medical Society. Des Moines.
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